# Vol. II

## TRANSCRIPT OF RECORD

## Supreme Court of the United States

OCTOBER TERM, 1943

## No. 54

THE WEBCO OIL CORPORATION, PETITIONER,

vs.

THE CONTINENTAL INVESTMENT COMPANY AND MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

## No. 55

THE WEBCO OIL CORPORATION, PETITIONER,

vs.

THE CONTINENTAL INVESTMENT COMPANY AND MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

PETITION FOR CERTIORARI FILED MARCH 26, 1943.

CERTIORARI GRANTED JUNE 7, 1943.

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[redacted]

[redacted]

IN THE

# Supreme Court of the United States

OCTOBER TERM, A. D. 1942.

No.

THE MERCOID CORPORATION,

*Petitioner,*

*vs.*

MID-CONTINENT INVESTMENT COMPANY, A CORPORATION, AND MINNEAPOLIS-HONEYWELL REGULATOR COMPANY,

*Respondents.*

ON WRIT OF CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE SEVENTH CIRCUIT.

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## In the
# United States Circuit Court of Appeals
## For the Seventh Circuit

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MID-CONTINENT INVESTMENT COMPANY, A Corporation, and MINNEAPOLIS HONEYWELL REGULATOR COMPANY,

*Plaintiffs-Appellants,*

No. 8008. vs.

THE MERCOID CORPORATION,

*Defendant-Appellee.*

---

MID-CONTINENT INVESTMENT COMPANY, A Corporation, and MINNEAPOLIS HONEYWELL REGULATOR COMPANY,

*Plaintiffs-Appellees,*

No. 8009. vs.

THE MERCOID CORPORATION,

*Defendant-Appellant.*

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Appeal from the District Court of the United States for the Northern District of Illinois, Eastern Division.

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TRANSCRIPT OF RECORD FILED MAY 14, 1942.
PRINTED RECORD.

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THE MERCOID CORPORATION,

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820 WALTER M. CROSS, JR., a witness on behalf of plaintiff Mid-Continent Investment Company, having been previously duly sworn, was recalled and testified in rebuttal as follows:

*Direct Examination by Mr. Stone.*

Q. Mr. Cross, toward the end of what year did the mandate from the Circuit Court of Appeals from the Eighth District come down to the District Court?

A. 1939.

Q. After that occurred, or after you had the decision from the Circuit Court of Appeals, you wrote a letter which I believe is in evidence here to The Mercoid Corporation, is that right?

A. That is correct.

Q. What were you attempting to do by virtue of that letter, Mr. Cross, and what transpired in the following months?

A. We felt we had validated the patent. Since Mercoid had been involved in the case they would now admit the validity of the patent and be willing to make an
821 accounting for royalties on controls which had been sold for use in the system prior to that time.

Q. Was it your understanding if the Cross patent was valid that one who made controls and prepared diagrams and literature showing exactly how those controls could be used in the infringing installation would be a contributory infringer?

A. Yes, it was. There would not be much choice. You could not sue everybody that put in a stoker control.

Q. It was your understanding they had made it possible for the public, the electricians and what not, to effect these actual direct infringements?

A. That is right.

Q. You were attempting to obtain an accounting from The Mercoid Corporation on the controls which they had actually made, is that right?

A. That is right.

Q. In the course of his examination, Mr. Courteol made two statements, one being on page 730 and reading as follows: "—it (meaning a license) was being pressed at them (that is Mid-Continent) by their licensor (that should be licensee, meaning the Minneapolis-Honeywell Com-

pany) to get The Mercoid Corporation lined up, that they had no choice in the matter other than force us to
822 take a license."

And on page 738 Mr. Courteol made this statement: "I made the statement Mr. Cross said he was being pressed by his licensor to conclude the agreement with The Mercoid Corporation."

What is your understanding about that situation?

A. Just this. Our interest was to collect damages and either have Mercoid acknowledge the patent and take the license or agree not to make the control any more. They claimed they were not making the control any more at that time, so the proposition evolved around the fact we wanted them to pay us for what damages had accrued and which we felt were due us under the judgment of the court in Missouri.

Q. Did you institute this proceeding yourself or with the Minneapolis-Honeywell Regulator Company?

A. We did it. We acted entirely independent. Minneapolis had nothing to do with our action.

Q. In the license agreement existing between you and Minneapolis-Honeywell what provision is made for the disposition of any damages awarded in a lawsuit to the plaintiff?

A. As I remember, the agreement provides if Mid-
823 Continent prosecuted an infringement case and is successful it shall retain any damages collected. Likewise, if Minneapolis-Honeywell were to share in the expense of prosecuting the litigation then they would receive an equal share with Mid-Continent of the damages.

Q. Who did pay the cost making up the legal fees attendant upon prosecuting the case down in Missouri?

A. The Mid-Continent Company.

Q. And so who was entitled to any damages that might be obtained from The Mercoid Corporation?

A. Mid-Continent only.

Q. You started negotiating directly with Mercoid because you alone were entitled to the damages, is that correct?

A. That is correct.

Q. Now, Mr. Cross, tell us how Minneapolis-Honeywell got into this at all,—got into the 1940 negotiations?

A. Well, some time, I believe about six months after I had a conference with Mercoid we placed the matter in the hands of our attorney, Mr. Spencer in Chicago,

and after talking to Mr. Moore he felt he could work out some agreement whereby it would be unnecessary to sue Mercoid in Chicago for an accounting. In the course of that it was suggested that a license agreement pro-
824 posal should be worked out. We informed Mr. Spencer that Minneapolis-Honeywell only had the right to sublicense under that patent. Later we were asked by Mr. Spencer if we could make a direct agreement with Mercoid. At that time we asked Minneapolis-Honeywell if it would make some arrangement whereby we could make a direct agreement and they agreed to do so provided that we modify the agreement of 1938 between Mid-Continent and Minneapolis-Honeywell allowing us to make this one single direct license to Mercoid.

Q. Do I understand you to say Minneapolis-Honeywell got into these negotiations only because of some proposal relating to licensing Mercoid to produce controls for its particular purpose in the future?

A. That is correct.

Q. If that had never come up you, the Mid-Continent Corporation, would simply have conducted these negotiations for the purpose of obtaining an accounting on all controls made by Mercoid for these infringer installations?

A. Yes; providing there was no question of their manufacturing controls any further.

Q. Did they tell you they had stopped making infringing controls?

825 A. Yes; they told me they were not making those controls any more.

Q. They referred specifically to what control?

A. I think it was the M-61. I think I am sure.

Q. The evidence has been brought out by Mr. Owens and by Mr. Schultz that the M-61 was discontinued in 1938, is that right?

A. Yes, sir.

Q. Was anything said about the TJV, the M-11 system or the JMV?

A. Not that I recall.

Q. Did they mention that?

A. No, they did not.

Q. So you had no means of knowing whether or not they were still putting out a system which infringed the Cross patent?

A. No; I didn't examine their books. I didn't know any of the details as to their business.

Q. When that figure of four or five thousand, whatever it is, was determined upon in that license agreement which was submitted by our office to the defendant in July or August, 1940, was there a basis in fact for your arriving at that figure?

A. Yes, sir, there was.

826 Q. It was not just a figure out here in vacuo, and which you might have made $20,000 if you had been so inclined?

A. No.

Q. What was the basis?

A. The basis was it approximated our cash outlay in validating the patent.

Q. Did Mercoid tell you how many controls they had put out?

A. Yes, they made estimates.

Q. Do you recall an estimate?

A. Well, I think there was an estimate based on possibly in the neighborhood of 7,000 controls, of which some had been sold in foreign countries and therefore would not come under the license agreement, and we finally agreed on an approximate number for the sake of discussion of a settlement. I believe that number was around four or five thousand controls.

Q. You are asking about one dollar for each installation and you knew these controls were specifically designed for that purpose and actually did go into the installation?

A. The specific one dollar royalty did not come into the discussion but that was the approximate set-up.

827 Q. So that the relationship between Mid-Continent and Minneapolis-Honeywell from late in 1939 to the institution of this suit was really a relationship in which you were asking them to do something in violation of your own license agreement, is that correct?

A. That is correct.

Q. Did you succeed in obtaining the consent of the Minneapolis-Honeywell Company to modify the 1938 license agreement between Mid-Continent and Minneapolis-Honeywell Company, Plaintiff's Exhibit 7?

A. Yes, we did.

Q. And it was understood you would grant The Mercoid Corporation a direct license?

A. That is correct.

Q. Was that in contravention to the policy of Mid-Continent in the previous ten years?

A. Yes, sir, it was. There had never been any exception asked to the agreement at all before.

Q. What Minneapolis-Honeywell Company really did was to accommodate the Mid-Continent Investment Company because of a very recalcitrant defendant, is that correct?

A. That is correct.

Q. Mr. Cross, I call your attention to these two letters which were sent out by Mid-Continent Investment
828 Company, one was to Fairbanks Morse Company and one was to the Brownell Company, and will ask you to state what the policy of Mid-Continent was in sending out notices relating to authority of the Cross patent? I am not going to ask you any specific questions. I just call your attention to those letters. What was your policy?

A. Our policy, as far as it laid within our power, was to notify the trade or the art that we did have such a patent and we considered the operation wherein controls were used to maintain fire responsive to temperature conditions in combination with a heating system to heat a house would infringe the Cross patent.

Q. What did you consider about manufacturers of controls which were specifically designed and sold with literature showing the purchaser how to use them to set up the installation? Did you consider them to infringe the Cross patent?

A. We always considered them as contributory infringers. They were the ones that made it possible to infringe the patent if it were held valid by the ultimate user and there was very little choice. We had the control manufacturers and the stoker manufacturers as the only two groups of people where you could reasonably enforce the patent.

829 Q. Now, Mr. Cross, would a controls manufacturer or any other manufacturer of specific equipment put into an infringing installation resent receiving notice of a patent warning or be pleased to receive it?

A. I should think he would be pleased to be put on notice there was such a patent situation.

Q. Mr. Cross, did you hear Mr. Owens make the following statement at the end of his cross examination by me? I am reading from pages 649 and 650 of the record:

"Q. So that one can conclude that at least a year or two

years after a control has left your plant it has been used some place for the purpose for which it was intended, is that correct?

"A. That is correct."

A. Yes, I heard him say that.

Q. Now, is that generally the fact in the controls industry so far as you know?

A. Yes, I think it is.

Q. Is that the reason why the stoker stack control was used as the measure for determining the number of installations in the field?

A. Yes.

Q. Minneapolis-Honeywell apparently felt it was reasonable to conclude a switch designed for this purpose
830 and sold with wiring diagrams showing how to use them for this purpose would get into an installation of the type intended?

A. Yes; that was the basis for the definition in our original agreement with them.

Q. And that basis for the definition has never changed?

A. No.

Q. Mid-Continent has never received any income from any source other than royalty, is that right?

A. As to the patent?

Q. As to this patent, I mean?

A. Yes, that is correct.

Q. This Cross patent in issue?

A. Yes.

Q. What is the life of a stoker stack switch with respect to the other elements of the combination in the Cross patent?

A. I think they are about the same.

Q. Can the stoker switch be considered as a supply in any way?

A. You mean something that would have to be bought frequently?

Q. Like coal—

A. No.

831 Q. (Continuing.) —for the furnace?

A. No, under no circumstances.

Q. So far as the public is concerned, since 1930, the date of the Cross patent, what position have the owners of the Cross patent taken?

A. We have made strenuous efforts to work the patent,

as the expression is, and to develop its validity since that time.

Q. When did you first bring suit on the patent?

A. We brought suit against the Schermes installation in Kansas City in 1934, I believe it was—no, about 1932, and I believe that was settled in 1934.

Q. When did you bring suit against Smith?

A. 1935.

Q. And you brought the present suit in 1940?

A. That is correct.

Q. The suit against Smith terminated in 1939?

A. 1939.

Q. So continuously since the time of this patent you have asserted its validity wherever you could assert it?

A. Yes, we have. We have done it in our district wherever we could do so.

Mr. Stone: I offer in evidence as PLAINTIFF'S EXHIBIT NO. 49 the M-61 control which had its serial
832 number read by Mr. Schultz.

Mr. Moore: That has been already offered in evidence, I believe.

Mr. Stone: I thought not.

As PLAINTIFF'S EXHIBIT 50 Mid-Continent offers an open ended sleeve with a flange mounting which accompanies a JMV Stokatherm manufactured by the defendant. (The exhibit was so marked.)

Mr. Stone: That is all for this witness.

Mr. Moore: No cross examination, your Honor.

(Witness excused.)

833 Mr. Stone: Mr. Cook, will you take the stand?

The Court: This is the same Mr. Cook who testified before?

Mr. Stone: Yes.

JUNIUS F. COOK, JR., a witness on behalf of the plaintiff Mid-Continent Investment Company, having been previously duly sworn, was recalled and testified in rebuttal as follows:

*Direct Examination by Mr. Stone.*

Q. Mr. Cook, did you hear Mr. Schultz's comments on the wiring diagram shown in Plaintiffs' Exhibit No. 39?

A. I did.

Q. Would you comment as to the pertiency in so far as infringement is concerned of the Cross patent in those comments?

A. Mr. Schultz pointed out that Exhibit 39 shows the high temperature cut out or protection switch connected into the grounded side of the line and said this would not be recommended by the Mercoid Company, who would recommend the connection of that switch in the hot line, but so far as any pertinency to the patent in-suit is concerned there is none.

834 I would say it is perhaps preferable to connect it on the high side of the line, but whether on the high or low side makes no difference whatever to the operation of the rest of the apparatus.

The other remark was to the effect Mercoid would not recommend the connection of the M-61 hold fire switch in the secondary circuit of the V2-3A relay. However, I have scrutinized the literature of Mercoid and I find no place where such a connection is not recommended, nor do I find any literature showing M-61 used with the V2-3A relay in which the connection is recommended in the primary circuit, that is, in the circuit of the stoker motor. I do find, however, that wherever hold fire switches are shown as in connection with the JMV relay or the TJV relay the hold fire switch is always recommended before connection or it is actually connected in parallel with the room thermostat connection of the secondary circuit of the relay.

Q. Referring to Plaintiffs' Exhibit No. 37, will you point out to the Court the elements contained in the Cross patented system?

Mr. Moore: I thought this witness had already pointed that out.

The Court: I thought so.

835 Mr. Stone: I want to direct the attention of this witness to one point.

The Court: Let's get to that point, then.

Mr. Stone: All right.

Q. Of the elements shown in Plaintiffs' Exhibit No. 37 are there patents on any one of them?

A. I understand that the M-61—

The Court: I can't hear you.

A. I understand the M-61 device is made under a separate patent and that the M-53 also is.

Mr. Stone: Q. 51?

A. 51 is also patented. No doubt there are patents under which room thermostats are made and possibly also there may be patent on the relay.

The Court: Q. Is there a patent on the stoker, too?

A. Depending on the stoker that you might use. The stoker itself might be individually patented. In fact, all of the individual elements might be individually patented.

Mr. Stone: Q. Was Judge Reeves affected by the fact there were patents on the systems in deciding whether or not the systems infringed on the patent?

The Court: What is the question?

(Question read as above recorded.)

836 Mr. Moore: I object. How can this witness tell what was in Judge Reeves' mind when he wrote his decision? The decision is a matter of record.

The Court: I will sustain the objection.

Mr. Stone: Q. Did you hear Mr. Schultz give his testimony concerning his opinion as to the construction and operation of the Mercoid TJV and JMV types of control?

A. I did.

Q. You remember he disagreed with you, didn't he?

A. I do.

Q. What was the nature of his disagreement?

A. Apparently Mr. Schultz and I are in substantial agreement in every respect except the matter of interpretation of the words "predetermined minimum temperatures" which occur in the claims. Mr. Schultz's opinion is based on a very narrow and strict interpretation of that language. Apparently he feels predetermined means a rigidly fixed and specific temperature at which the relay must operate at all times.

My opinion is based on a somewhat more liberal interpretation of that language, that it is my understanding that the patent is to be interpreted as broadly as possible in view of limiting prior art. Judge Reeves' decision 837 was to the effect the patent is entitled to extremely broad interpretation. Therefore, in the absence of limiting prior art, and there is no prior art in this particular situation that requires the patent to be limited to any particular operating temperature, it is my opinion the language over which Mr. Schultz and I are in disagreement is entitled to a broad interpretation, and so interpreted covers not only the infringing arrangement shown in Exhibit 37 but also the TJV and JMV devices.

Q. Mr. Cook, have you examined Plaintiffs' Exhibit 6 in the Kansas City suit?

A. I have.

Q. What does that show as to the drop in stack temperatures?

A. That shows the curve representing the stack temperature against time. It might be referred to as a cooling curve.

Q. That is the rate of fall from a given high,—fast or slow.

A. The chart shows that stack temperature falls very rapidly from a high temperature during the first part of the cooling cycle. That is because the very high temperatures in the stack are primarily caused by the heat
838 in the gases which are passing through the flue. After the temperature has fallen almost vertically on the curve to the point where the temperature approaches the natural temperature of the stack itself,—by that I mean the temperature due to the heat of the materials of which the stack is formed—when the temperature reaches that temperature the stack then proceeds to cool, largely by conduction and radiation, from the stack without the effect of high temperature gases passing through the stack, because during that period there is a very little amount of products, heat products of combustion passing through the stack and the stack tends to cool off simply as a result of dissipating its own heat through radiation. That is a very slow rate of cooling.

Q. In Plaintiffs' Exhibit 6—

Mr. Freeman: Why don't you refer to Plaintiffs' Exhibit 6 in the former suit?

Mr. Stone: Q. (Continuing.) —of the former suit in the first hour the stack temperature, speaking in percentages, dropped how far toward the minimum level of the stack whether the stoker or whatever heating system is used is not turned on?

A. Well, it is easier to say half hour periods. In the first half hour the stack temperature on this par-
839 ticular installation dropped from 1000 degrees Fahrenheit to 400 degrees Fahrenheit, which is I would estimate about 90 per cent of the minimum stack temperature. That was in the first half hour. That was the period during which this very rapid drop in temperature took place. After that half hour was over the stack temperature pro-

ceeded to cool off at a very much slower rate, represented by the nearly horizontal portion of the cooling curve. This curve shows whereas it only took a half hour to cool off 600 degrees Fahrenheit, it took nine hours thereafter to cool off another 150 degrees.

Q. Now, Mr. Cook, I show you Plaintiffs' Exhibit No. 41. Assume the timer is set at 30 minutes and further assume it is connected to an M-11 and installed in a system which shows the exact temperature curve, Plaintiffs' Exhibit 6 of the former suit, and ask you how the TJV would operate after a room thermostat has ceased calling for heat at any given point?

Mr. Moore: If the Court please, I think all this has been gone into on his direct examination and it is merely repetition.

Mr. Stone: It is not repetition because Mr. Moore brought out this thing can function in various ways.

840 The Court: Didn't he manipulate this apparatus when he was on the stand before?

Mr. Stone: Oh, yes, but he is now showing as a matter of fact on an actual installation, on an actual experimental test which was conducted in the other case this thing will function about as the M-61 functioned.

Mr. Moore: This was not in the other case.

Mr. Stone: We are proving equivalency.

Q. How does this one function as compared to the M-61, that is, the TJV as compared with the M-61, in a falling stack temperature such as that shown in Plaintiffs' Exhibit 6 in that suit?

A. If the time adjustment is made in the fashion recommended in The Mercoid literature, that is to say in such a way as to cause this system, this TJV system to operate in a manner to prevent the wastage of fuel, the device will operate to turn the stoker motor in just about the same identical time and position on the curve as the M-61 switch will if properly set. In other words, both the M-61 installation in Exhibit 37 and this TJV system if properly adjusted will work about the same.

Q. How about the JMV system, Plaintiffs' Exhibit No. 44?

A. That statement is true also of the JMV.

841 Mr. Stone: That is all.

*Cross-Examination by Mr. Moore.*

Q. You have not made any actual tests yourself personally in regard to the statement you have just made in regard to this change of temperature and the operation of these devices, have you?

A. No; the only thing I have done is to take the type and cooling curve and the chimney and follow the recommendation of Mercoid to satisfy myself how the devices will operate.

Q. They are just your opinion?

A. That is right.

Mr. Moore: Cross examination finished on the part of Mercoid.

(Witness excused.)

843 EXHIBIT 3.

Mandate of the Circuit Court of Appeals.

United States of America } ss.

(Seal)

To the Honorable the Judges of the District Court of the United States for the Western District of Missouri. Greeting:

Whereas lately in the District Court of the United States for the Western District of Missouri, before you or some of you in a cause between Mid-Continent Investment Company, a corporation, Plaintiff and E. O. Smith, Defendant No. 115 In Equity wherein the decree of said District Court in said cause entered on the 18th day of Oc... A. D. 1937 was in the following words, viz:

"This cause coming on for decisions at this term the same having been tried and argued on the 16th and 17th days of February, 1937 and taken under advisement and upon the consideration thereof it was Ordered, Adjudged and Decreed as follows, viz:

(1) That the patent in suit No. 1758146 was duly issued to Walter M. Cross assignor to Cross Coal-O-Matic Company on May 13th, 1930 and that the same is valid patent;

(2) That all of the right, title and interest in, and to said Letters Patent of the United States together with

the exclusive rights and privileges granted thereby were at the time of the commencement of this action and are now vested solely and exclusively in the plaintiff by virtue of written instruments of assignment duly executed acknowledged and delivered in the form and manner required by law;

(3) That the defendant in his residence located at 102 Howard Street, Cathage, Missouri and within this judicial district installed a dual thermostatic control mechanism in connection with the force draft domestic heating system (furnace) having a power driver underfeed stoking element, said dual thermostatic control mechanism being connected to the stoker driving means of the furnace, one thermostat being installed in the space to be heated and the other in the breeching or stack of the furnace one thermostat functioning and actuated by variations of the temperature in the space to be heated and the other by predetermined minimum temperature in the furnace to prevent extinguishing of the fire when operating under low heat requirements conditions;

That the installation and use thereof by the defendant constitutes an infringement of the plaintiff's patent No. 1758146 and of claims numbered One to Five inclusive of said Letters Patent;

844 (4) That appropriate notice was given to the defendant by the plaintiff informing him of the existence of said Letters Patent and the invention thereby described and that said defendant in using and employing the inventions was infringing said Letters Patent and demanding that defendant cease and desist from the use of said invention and for an accounting;

(5) That said Letters Patent of the United States No. 1758146 and the five claims thereof are in full respects valid and that the defendant had infringed and is continuing to infringe said Letters Patent;

(6) That the defendant be and he is hereby perpetually enjoined against infringing said Letters Patent of the United States No. 1758146 or any of the inventions covered thereby;

(7) That the damages involved are too small to justify the expense of a reference to as Master; that the plaintiff have and recover from the defendant the sum of One Dollar ($1.00) for damages by reason of the infringement of said Letters Patent;

(8) That the Findings of Fact numbered 1 to 16 inclusive and the Conclusions of Law numbered 1 to 6, made by the Court in this cause and filed with the Clerk shall be entered of record herein:

(9) The costs of this action be and the same hereby are assessed against the defendant.

Dated this 18th day of October, 1937.

Albert L. Reeves,
*United States District Judge.*

as by the inspection of the transcript of the record of the said District Court, which was brought into the United States Circuit Court of Appeals Eighth Circuit by virtue of an appeal agreeably to the Act of Congress in such case made and provided, fully and at large appears:

And Whereas at the May term in the year of our Lord one thousand nine hundred and thirty nine the said cause came on to be heard before the said United States Court and was argued by counsel.

On consideration Whereof it is now here ordered, adjudged and decreed by this court, that the decree of the said District Court in this cause be and the same is hereby affirmed with costs and that the Mid-Continent Investment Company, a corpofation have and recover against E. O. Smith the sum of Twenty Dollars for its costs herein and have execution therefor.

September 12, 1939.

You, therefore, are hereby commanded that such execution and proceedings be had in said cause at according to right and justice and the laws of the United States, ought to be had, the said appeal notwithstanding.

845 Witness the Honorable Charles E. Hughes, Chief Justice of the United States, the 23rd day of October in the year of our Lord one thousand nine hundred and thirty nine.

E. E. Koch,
*Clerk of the United States Circuit Court of Appeals, Eighth Circuit.*

Costs of Appellee
Attorney—$20.00.

Filed—Oct. 25, 1939. A. L. Arnold, Clerk. A. Ruffin, D. C.

# Plaintiff's Exhibit 4

# MERCOID COAL STOKER CONTROLS

ALL INSTRUMENTS EQUIPPED WITH THE MERCOID SEALED MERCURY CONTACT SWITCH

## COMBINATION—TYPE H SENSATHERM AND TYPE V RELAY

**For Low Voltage Thermostatic Regulation**

The Mercoid Type H Sensatherm and Type V Relay combination is especially recommended for automatic coal stoker applications.

Both of these instruments are equipped with the Mercoid sealed mercury contact switch, which is not affected by dust, dirt or corrosion. Burning, pitting, sticking—sources of service trouble and expense with open-to-air contacts,—cannot occur with the sealed Mercoid switch.

The Type H low voltage Sensatherm is not only small in size and neat in appearance, but is very sensitive to room temperature changes. This instrument has an adjustable range from 55 to 85° F., and a differential of plus or minus ½° F. (total differential 1° F.).

The Type V Relay, by transformer action, induces its own low voltage on the thermostat circuit. This is a quiet relay as it operates on the repulsion principle. As the conventional clapper type armature is not used, there can be no noises from dirty, rusty or uneven armature faces.

**TYPE V3-3A**: Single pole, 10 amp. 110V.-60 cycle.

**TYPE V3-3F**: Single pole, 5 amp. 220V.-60 cycle.

**MOTOR RATING**: 1 H.P. Repulsion-Induction, ½ H.P. Split-Phase.

| TYPE NO | | LIST PRICE |
|---|---|---|
| H | SENSATHERM | $7.50 |
| V3-3A | RELAY | 9.00 |
| V3-3F | RELAY | 9.00 |

For further information on Type H Sensatherm refer to page 3. For further information on Type V Relay refer to page 5.

TJ-V STOKATHERM

## MERCOID STOKATHERM CONTROL SYSTEM

Several years intensive study of the needs of the stoker field has resulted in the development of a control system that fully meets all requirements.

The MERCOID STOKATHERM CONTROL SYSTEM, based on a new principle of operation, effectively combines the advantages of Timer and stack controls, and at the same time overcomes the former weaknesses and disadvantages of these devices. This system consists of two units, the Type TJ-V Stokatherm and the Type M-11 Pyratherm. These units operate in conjunction with each other to produce the most satisfactory and economical operation attainable with automatic coal stokers.

The Stokatherm Control System incorporates the following important features:

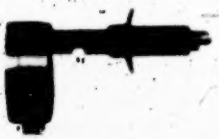
### FIRE MAINTAINING

The Stokatherm operates the stoker for only the very shortest periods necessary to maintain a minimum fire while the thermostat is in the off position.

The firing periods are not at definitely timed intervals or governed by fixed stack temperatures, but are automatically regulated to meet the variable conditions encountered on each installation. As domestic stokers operate approximately 80% of the heating season on the fire maintaining controls, the economical, short operations of the Stokatherm not only result in a very decided fuel saving, but also insure against overheating.

### AUTOMATIC COMPENSATION FOR VARIATIONS IN FUEL

If the fuel delivered to the stoker should have a higher or lower burning rate than that formerly used, the Stokatherm System automatically compensates for this and changes its firing period accordingly. This eliminates service due to overheating or out fire.



M-11 PYRATHERM

### OUT-FIRE OPERATION

Should the fuel become exhausted, or the fire go out, the Stokatherm System automatically stops the stoker. This prevents operating an empty stoker and guards against filling the combustion chamber with unburned fuel—a condition most unpleasant to the operator.

The Mercoid Transformer Relay built into this control induces its own low voltage on the thermostat circuit. The Mercoid-sealed mercury contact switches, which are used throughout, eliminate unnecessary service as they cannot be affected by dust, dirt or corrosive gases.

**ELECTRICAL CAPACITY**: Standard for 10 amp.-110V., 60 cycle. Available at no extra charge for 5 amp.-220V., 60 cycle.

**MOTOR RATING**: 1 H.P. Repulsion-Induction, ½ H.P. Split-Phase.

| TYPE NO | SPECIFICATION | LIST PRICE |
|---|---|---|
| TJ-V | STOKATHERM | $24.50 |
| M-11 | PYRATHERM | 9.50 |

Be sure and specify both type TJ-V and Type M-11 when ordering. Also specify whether for 110 or 220V.-60 cycle.

**SHIPPING WEIGHT**

TYPE TJ-V STOKATHERM
Approximately 10 Lbs.

TYPE M-11 PYRATHERM
Approximately 4½ Lbs.

For complete information refer to Catalog Bulletin No. 241A.

M-61 STOKER CONTROL

SIDE VIEW SHOWING STAINLESS STEEL WELL

## TYPE M-61 STOKER CONTROL

Type M-61 is a stack-mounted, temperature-operated control, designed to fire the stoker intermittently during the period the room thermostat is in the "off" position. This same instrument may also be used as a high stack temperature limit control.

Particular attention is called to the dial in the center of the instrument, which is clearly and accurately calibrated from 50° to 650° F. A simple double adjustment is provided for individually setting both the "cut-in" and "cut-out" temperatures. This desirable feature permits quick setting to meet the variety of conditions encountered in stoker installations.

Another feature is the temperature indicator located over the dial, which indicates the temperature within the stack. Serving the same purpose as a thermometer, this indicator assists in determining the proper size of fire required and in correctly setting the controls.

Standard instruments are furnished with a stainless steel well enclosing the bi-metal operating coil. This protects the coil, not only from deposits of fly ash, but also against corrosive stack gases.

**ELECTRICAL CAPACITY**: Either A.C. or D.C., 10 amp.-110V., 5 amp.-220V.

**MOTOR RATING**: 1 H.P. Repulsion-Induction, ½ H.P. Split-Phase or D.C.

| TYPE NO | SPECIFICATION | LIST PRICE |
|---|---|---|
| M-61 | With S.S. Well | $14.00 |
| M-61 | Without S.S. Well | 11.00 |

**SHIPPING WEIGHT**

Approximately 4½ Lbs.

For complete information refer to Catalog Bulletin No. 240B.

847 This Assignment Witnesseth, That, Whereas, the Cross Coal-O-Matic Company, a corporation organized and existing under and by virtue of the laws of the State of Missouri, and having its principal place of business at Kansas City, Missouri, is the sole owner of U. S. Letters Patent No. 1,758,146, and

Whereas, the Mid-Continent Investment Company, a corporation organized and existing under and by virtue of the laws of the State of Missouri, and having its principal place of business at 700 Baltimore, Kansas City, Missouri, is desirous of acquiring an interest in the above U. S. Latters Patent, and

Now, Therefore, in consideration of the sum of One Dollar in hand paid and other good and valuable considerations, the receipt of which is hereby acknowledged, the Cross Coal-O-Matic Company does hereby transfer, set over, and assign unto the said Mid-Continent Investment Company, its successors, and assigns, all of its right, title, and interest in and to said invention.

In Witness Whereof, the said Cross Coal-O-Matic Company has hereunto set its hand and affixed its seal at Kansas City, Missouri, this 7th day of June, 1932.

Cross Coal-O-Matic Company,
By (Sgd.) Forbes. Cross.

848 State of Missouri, } ss.
County of Jackson. }

Before me, a Notary Public in and for the County and State aforesaid, personally appeared Forbes Cross, to me personally known as Vice President of the Cross Coal-o-matic Company, who duly acknowledged that he signed, sealed, and delivered the foregoing instrument as his free and voluntary act and deed and for the uses and purposes therein set forth.

In Testimony Whereof, I have hereunto set my hand and affixed my seal at Kansas City, Missouri, this 7th Day of June, 1932.

(Sgd.) Gertrude Clingenpeel,
(Seal) *Notary Public.*

849 AGREEMENT.

Agreement made and entered into this 23rd day of Decembes, 1931 by and between Cross Coal-O-Matic Company, a corporation organized and existing under the laws of the State of Missouri and having a principal place of business at Kansas City, Missouri, hereinafter called "Cross", and Butler Manufacturing Company, a corporation organized and existing under the laws of the State of Missouri, and having a principal place of business at 7400 East Thirteenth Street, Kansas City, Missouri, hereinafter called "Butler", and Minneapolis-Honeywell Regulator Company, a corporation organized and existing under the laws of the State of Delaware and having a principal place of business at 2727 Fourth Avenue South, Minneapolis, Minnesota, hereinafter called "Minneapolis"; Witnesseth:

A.

Whereas, Cross is the present owner of the entire right, title and interest, except for the hereinafter recited rights of Butler, in and to the following United States patents, and the inventions therein set forth:

| Number | Invenfor | Granted | Invention |
|---|---|---|---|
| Patent 1,758,146 | Walter M. Cross | May 13, 1930 | Domestic Heating System |
| Patent 1,758,147 | Walter M. Cross | May 13, 1930 | Heating System Control |

B.

Whereas, Butler is engaged in the manufacture and sale of heating apparatus and particularly automatic coal stokers for heating apparatus and, being desirous of
850 using said system and or control inventions in combination with sales of stokers made by it, duly heretofore entered into on September 22, 1931, an agreement with Cross, whereby Butler received and is now possessed of the sole and exclusive right and license to make, use

and sell said System and or Control inventions, subject to royalty payments therefor to Cross.

C.

Whereas, Minneapolis is engaged in the manufacture and sale of various control devices and systems, including devices and systems for the control of heating apparatus, and is desirous of acquiring the sole and exclusive right and license, and the right to grant sub-licenses, upon royalty payments, to make, use and sell said System and Control inventions, subject only to the right of Cross or one of its licenses to purchase from Minneapolis the hereinafter recited stoker switches made by Minneapolis for resale by Cross or one of its licensees only in combination with stokers manufactured and sold by Cross or one of its licensees, upon preferred terms as hereinafter set forth.

Now, Therefore, in consideration of One Dollar ($1.00) in cash, each to the other in hand paid, the receipts whereof are jointly and severally acknowledged, and in consideration of the mutual representations, covenants and agreements herein set out, the three parties hereto jointly and severally represent, covenant and agree as follows:

1. Cross and Butler jointly and severally grant to Minneapolis the sole and exclusive right and license to make, use and sell and to sub-license others to make, use and
851 sell, the inventions disclosed in said patents as applied to coal stokers, and all improvements thereon which inventions and improvements may be the subject of patents, or divisions, renewals, continuations, and or reissues thereof, now or hereafter owned, controlled and or acquired by Cross and or Butler, throughout the territory of the United States and its possessions for the life of said patents, unless said rights and license are sooner terminated in accordance with the provisions hereof.

2. It is jointly and severally agreed by all of the parties hereto that royalty payments to be made hereunder shall be made or based only upon what are known to the parties hereto as a "combustion stoker switch" which is specifically herein defined as a combination stoker control unit including an automatic electric switch responsive directly to temperatures of combustion gases or boiler water produced by an automatic coal-fuel stoker and adapted, in

combination with other devices and apparatus, for the control of automatically operated coal-fuel stokers, to prevent the extinguishment of its fire when operating under low heat requirement conditions.

3. Minneapolis agrees to pay as earned royalty for each licensed combustion stoker switch made and sold by it and by any of its sub-licensees, pursuant to the provisions of this license, a sum equal to Five Percent (5%) of the net sales price of each combustion stoker switch; provided, however, the minimum royalty per switch shall not be less than Seventy Five Cents (75¢).

4. Minneapolis agrees to pay, during the existence of this agreement, a minimum guaranteed royalty of One
852 Thousand Dollars ($1,000.) for the period beginning with the execution of this agreement and ending December 31, 1932, one-half to be paid on the execution of this Agreement and the other half on July 15, 1932, and a minimum guaranteed royalty of Fifteen Hundred Dollars ($1,500.) for the calendar year 1933, and a minimum guaranteed royalty of Twenty Five Hundred Dollars ($2,500.) for the calendar year 1934 and each year thereafter, to be paid in equal half-yearly payments on January 15th and July 15th of each year; provided, however, that if in said initial period or in any calendar year thereafter, the earned royalties due and payable hereunder exceed the guaranteed minimum annual royalties, then only the excess of earned royalties over said minimum annual royalties, plus the minimum annual royalties, shall be due and payable by Minneapolis; and, provided, further, that in the event of termination of this Agreement as herein provided, said minimum annual royalty payment for the then-current year shall be pro-rated and such pro-rated part for the expired portion of the then-current year shall constitute the limit of liability of Minneapolis for minimum annual royalty for each year.

5. Cross and Butler jointly and severally authorize and direct that any and all royalties provided to be paid by Minneapolis hereunder shall be paid to Butler except in the event that the above recited agreement of Cross and Butler, dated September 22, 1931, has been terminated and that all rights of Butler under said patents have reverted to Cross, in which event, after notice by Cross of such termination, Minneapolis shall thereafter pay said royalties under this license to Cross and or its assigns.

853 6. Pursuant to the preceding authorization and directions, Minneapolis agrees to pay the royalties due hereunder to Butler and to make quarterly statements to Butler on the fifteenth (15th) day of January, April, July and October of each year during the existence of this agreement, showing the sales made of said combustion stoker switches for the quarterly period ending with the last day of the month preceding each such statement, and Minneapolis agrees to accompany each such statement with the license fees thereby shown to be due, less any payment of minimum guaranteed royalties theretofore made during the calendar year in which such statement was rendered.

7. Minneapolis agrees to and will require all its sublicensees to keep accurate books of account concerning sales and transactions pertaining to said combustion stoker switches and agrees that Cross or Butler shall be permitted, through certified public accountants, to examine such books of account at reasonable times, it being understood that such examinations shall be limited to sales and transactions of combustion stoker switches.

8. It is jointly and severally agreed that, for the purposes of this Agreement, said switches shall be considered to be sold when billed out, or if not billed out, then when delivered, or when paid for, if paid for before delivery; and it is further so agreed that royalties paid on switches which are lost or damaged in transit or otherwise defective, and not accepted by the customers, may be deducted from further royalty payments to be made hereunder.

9. Minneapolis agrees to sell control units to Cross or one of its licensees (who at present is Butler) at as low a price as Minneapolis shall sell similar control units
854 to any other manufacturer of oil burners or stokers, provided, however, that Minneapolis shall not be obligated to sell Cross or one of its licensees said control units in excess of the number actually required by Cross or one of its licensees for the control of stokers as made and sold by Cross or one of its licensees.

10. Cross or one of its licensees agrees to refrain from selling said controls and or systems purchased from Minneapolis except in conjunction with stokers made and sold by Cross or one of its licensees.

11. Butler and Cross jointly and severally agree that Minneapolis shall have the right to sue infringers but such right shall be limited to systems employing devices such as combustion stoker switches as herein defined which may

be an infringement of any patents subject to this Agreement or any reissues thereof, in the name of Cross and or of Butler, as may be necessary, but in the event of the bringing of any such suit by Butler or Cross or Minneapolis, the party bringing such suit shall bear all the expenses of such litigation and be entitled to retain all recoveries, and Butler and Cross and Minneapolis jointly and severally agree that in the event any such suit is brought by two or more of the parties, the expenses of litigation and or recoveries therefrom shall be equally shared by the parties bringing such suit and Cross and one of its licensees or either of them reserves the right to join and participate in any suit which may be brought on the aforesaid patents and to share in the expense and recovery thereof. In the event Minneapolis brings any such action in the name of Butler and or Cross then Minneapolis shall protect Butler and or Cross from all costs expenses and or damages which accrue against Butler and or Cross on account of or growing out of any such action.

12. It is mutually agreed between the three parties that it may seem advantageous to apply for reissue of either one or both of the above listed patents on or before May 12, 1932 and it is mutually agreed that in the event it shall be decided so to reissue either or both said patents, the three parties will cooperate in such reissue or reissues; provided, however, that the control and expense of the prosecution of any such reissue applications shall remain in said Cross, and Cross agrees that it will give full information to Minneapolis and Butler as to the preparation and filing of such reissue application or applications and will employ able and duly qualified patent counsel for that purpose and will give due consideration to the advice and suggestions of the other party or parties relative thereto in order that the best possible patent protection may be obtained for the benefit of the various parties to this Agreement.

13. Minneapolis shall have the right to terminate this Agreement on December 31st of any year during its continuance by previous notice thereof in writing, mailed postage prepaid, not later than the first day of November next preceding, to Cross and one of its licensees, if any, addressed to their last known place of business, whereupon this License Agreement shall cease and all rights and liabilities of Minneapolis shall terminate without prejudice

to any rights of Butler or Cross to recover any moneys then due by way of royalties prior to such termination.

14. Minneapolis agrees that, in the event Minneapolis shall grant any sub-licenses hereunder, each sub-
856 license shall be so restricted as to terminate simultaneously with the termination of this License Agreement; and Minneapolis shall pay Cross or one of its licensees earned royalty for each sub-licensed combustion stoker switch made and sold by each sub-licensee as if each such sub-licensed switch were made and sold by Minneapolis and all earned royalties so paid by Minneapolis shall be considered as earned royalty payments by Minneapolis for the purpose of determining whether minimum annual royalty payments herein provided have been exceeded.

15. Minneapolis agrees that it will comply with the United States Patent Statutes with respect to the marking of said switches made and sold under this license with the word "Patent" and the number or numbers of the patents applicable thereto and will insert such requirement in each sub-license granted by it.

16. If the royalties herein provided shall at any time be in arrear for thirty (30) days after they shall become due, or if Minneapolis shall become bankrupt or insolvent or enter into any settlement with its creditors, or shall make any default in performing any of the agreements herein contained, then, and in such case, Butler, or Cross in the event of reversion of Butler's rights to Cross, shall have the right by notice in writing mailed Minneapolis postage prepaid to its last known place of business, to revoke this License, which shall become void the thirtieth (30th) day thereafter unless Minneapolis shall have previously remedied such default or arrear, without prejudice to any right of action or remedy of Butler or Cross for the recovery of any moneys then due and accrued to the date of cancellation, to Butler or Cross hereunder, or in respect of any antecedent breach of any agreement herein contained.

857 17. If the Cross patent, No. 1,758,146, shall be adjudicated by a court of competent appellate jurisdiction or by a trial court from which no appeal is taken, invalid or shall be thereby so restricted in its scope as to be of no practical benefit to Minneapolis by way of preventing unlicensed competition, then, and in either such event, Minneapolis shall have the right, upon notice in writing mailed postage prepaid addressed to Butler and or

Cross at its last known place of business, to discontinue any and all further royalty payments hereunder and thereupon this contract shall terminate.

18. Butler or Cross agree that they have not heretofore made, and will not make any agreement or do any act in derogation or contravention of any right hereby granted Minneapolis.

19. Minneapolis agrees that it will not contest the validity of either of the above recited patents during the existence of this License Agreement and agrees that it will, during the existence of this License Agreement, assist Cross in the preparation and prosecution of the above-mentioned reissue and in upholding the validity of said patents.

20. This License Agreement shall inure to the benefit of the successors and or assigns of the three parties hereto provided such successors and or assigns shall agree to, and accept, the obligations and liabilities of such predecessor and or assignor.

In Witness Whereof, the parties hereto have caused this Agreement to be signed by their respective duly authorized officers and their respective corporate seals to be affixed.

858. December 23rd, 1931.

Butler Manufacturing Company,
By E. E. Norquist.

Attest:
F. A. Rufi,
*Secretary.*

December 23rd, 1931.

Cross Coal-O-Matic Company,
By Forbes Cross,
*Vice President.*

Attest:
Walter M. Cross, Jr.,
*Secretary.*

December 29th, 1931.

Minneapolis-Honeywell Regulator Company,
By Julius K. Luthe,
*Vice President.*

Attest:
F. S. Stinson,
*Asst. Secretary.*

State of Missouri } ss.
County of Jackson }

On this 23rd day of December, 1931, before me, appeared E. E. Norquist, to me personally known, who, being by me duly sworn did say that he is President of Butler Manufacturing Company, and that the seal of the foregoing instrument is the corporate seal of said corporation, and that said instrument was signed and sealed in behalf of said corporation by authority of its board of directors, and said E. E. Norquist acknowledged said instrument to be the free act and deed of said corporation.

Louis Brown,
*Notary Public.*

(Seal)
Commission expires March 7, 1932.

859 State of Missouri } ss.
County of Jackson }

On this 23rd day of December, 1931, before me appeared Forbes Cross, to me personally known, who, being by me duly sworn did say that he is Vice President of Cross Coal-O-Matic Company, and that the seal to the foregoing instrument is the corporate seal of said corporation, and that said instrument was signed and sealed in behalf of said corporation by authority of its board of directors, and said Forbes Cross acknowledged said instrument to be the free act and deed of said corporation.

Gertrude Clingenpeel,
*Notary Public.*

My commission expires June 7, 1934.

State of Minnesota, } ss.
County of Hennepin. }

On this 29th day of December, 1931, before me appeared Julius K. Luthe, to me personally known, who, being by me duly sworn, did say that he is the Vice President of Minneapolis-Honeywell Regulator Company, that the seal affixed to the foregoing instrument is the corporate seal of said corporation, and that said instrument was executed in behalf of said corporation by authority of its board of di-

rectors; and said Julius K. Luthe acknowledged said instrument to be the free act and deed of said corporation.

J. Vandergon,
*Notary Public, Hennepin County, Minnesota.*

My commission expired Feb. 15, 1933.

860 LICENSE AGREEMENT.

Agreement made as of the 31st day of December, 1938, by and between Mid-Continent Investment Company, Inc., a corporation organized and existing under the laws of the State of Missouri, and having a principal place of business at Kansas City, Missouri, hereinafter called "Mid-Continent", and Minneapolis-Honeywell Regulator Company, a corporation organized and existing under the laws of the State of Delaware and having a principal place of business at Minneapolis, Minnesota, hereinafter called "Minneapolis",

Witnesseth

Whereas, Mid-Continent is the present owner of the entire right, title and interest in and to the following United States patents and the inventions therein set forth:

Number, Patent 1,758,146; Inventor, Walter M. Cross; Granted, May 13, 1930; Invention, Domestic Heating System.

Number, Patent 1,758,147; Inventor, Walter M. Cross; Granted, May 13, 1930; Invention, Heating System Control.

Whereas, said patents were formerly owned by Cross Coal-O-Matic Company, the assets of which are now entirely owned by Mid-Continent;

Whereas, Cross Coal-O-Matic Company entered into an agreement September 22, 1931, with Butler Manufacturing Company of Kansas City, Missouri, and subsequent thereto Cross Coal-O-Matic Company, Butler Manufacturing Company, and Minneapolis, on the 23rd day of December 1931, entered into a three-party agreement granting to Minneapolis, among other things, an exclusive license under said Cross patents.

861 Whereas, Butler Manufacturing Company heretofore gave up its rights under and cancelled said agreement entered into with Cross Coal-O-Matic Company Sep-

tember 22, 1931, and Minneapolis has now terminated said three-party agreement of December 23, 1931, effective as of the 31st day of December 1938;

Whereas, Minneapolis and Mid-Continent are desirous of entering into a new agreement in relation to said Cross patents whereby Minneapolis will be permitted to continue its manufacture and sale of apparatus and systems under said Cross patents.

Now, Therefore, in consideration of One Dollar ($1.00) in cash paid by Minneapolis to Mid-Continent, the receipt whereof is hereby acknowledged, and in consideration of the mutual representations, covenants and agreements herein set out, Minneapolis and Mid-Continent jointly and severally represent, covenant and agree as follows:

1. Mid-Continent hereby grants to Minneapolis the sole and exclusive right and license to make, use and sell and to sub-license others to make, use and sell, the inventions disclosed in said patents as applied to coal stokers, and all improvements thereon which inventions and improvements may be the subject of patents, or divisions, renewals, continuations, and or reissues thereof, now or hereafter owned, controlled and or acquired by Mid-Continent, throughout the territory of the United States and its possessions for the life of said patents, unless said rights and license are sooner terminated in accordance with the provisions hereof.

2. It is jointly and severally agreed by the parties hereto that royalty payments to be made hereunder shall be made or based only upon what are known to the par-
862 ties hereto as a "combustion stoker switch" which is specifically herein defined as a combustion stoker control unit including an automatic electric switch responsive directly to temperatures of combustion gases or boiler water produced by an automatic coal-fuel stoker and adapted, in combination with other devices and apparatus, for the control of automatically operated coal fuel stokers, to prevent the extinguishment of its fire when operating under low heat requirement conditions.

3. Minneapolis agrees to pay an earned royalty on each licensed combustion stoker switch according to the following method of computation:

At the end of each calendar year, Minneapolis will total the net sales in dollars of all sales of combustion stoker switches made to those customers classified as "manu-

facturers" by Minneapolis and pay an earned royalty of five percent (5%) of such dollar total.

Also, at the end of each calendar year, Minneapolis will determine from its usual annual inventory the total number of Licensed combustion stoker switches of each type sold during the preceding calendar year and will deduct from each such total the number of such combustion stoker switches sold to "manufacturers". The remainder will be considered as having been sold to "dealers". Minneapolis will pay an earned royalty on each such combustion stoker switch sold to a "dealer" at the rate of five percent. (5%) of the list price on that particular type of combustion stoker switch minus 25% and 20%. (example—5% of ($5.00 minus 25% and 20%)—$0.15)

4. In the event Minneapolis grants any sub-licenses hereunder, Minneapolis will pay to Mid-Continent an earned royalty on each licensed combustion stoker switch sold by such sub-licensees, the earned royalty to be paid being based upon the total dollar sales and list prices
863 of such sub-licensees and computed in the manner set forth in paragraph three hereof.

5. Starting with the year 1940, Minneapolis agrees to make yearly reports to Mid-Continent not later than the fifteenth day of February of each year separately setting out the total number of licensed combustion stoker switches sold by it and its sub-licensees during the preceding year to "manufacturers" and "dealers" together with the prices to "manufacturers" and the list prices upon which the "dealer" prices are based and to accompany each such report with the royalties thereby shown to be due Mid-Continent.

6. Minneapolis agrees to and will require all its sub-licensees to keep accurate books of account concerning sales and transactions pertaining to said combustion stoker switches and agrees that Mid-Continent shall be permitted, through certified public accountants, to examine such books of account at reasonable times, it being understood that such examinations shall be limited to sales and transactions of combustion stoker switches.

7. It is jointly and severally agreed that, for the purposes of this Agreement, said switches shall be considered to be sold when billed out, or if not billed out, then when delivered, or when paid for, if paid for before delivery; and it is further so agreed that royalties paid on switches which are lost or damaged in transit or otherwise defec-

tive, and not accepted by the customers; may be deducted from further royalty payments to be made hereunder.

8. Minneapolis agrees to sell control units to Mid-Continent at as low a price as Minneapolis shall sell similar control units to any other manufacturer of oil burners or stokers, provided, however, that Minneapolis shall
864 not be obligated to sell Mid-Continent said control units in excess of the number actually required by Mid-Continent for the control of stokers as made and sold by Mid-Continent.

9. Mid-Continent agrees to refrain from selling said controls and or systems purchased from Minneapolis except in conjunction with stokers made and sold by Mid-Continent.

10. Mid-Continent agrees that Minneapolis shall have the right to sue infringers but such right shall be limited to systems employing devices such as combustion stoker switches as herein defined which may be an infringement of any patents subject to this Agreement or any reissues thereof, in the name of Mid-Continent, but in the event of the bringing of any such suit by Mid-Continent or Minneapolis, the party bringing such suit shall bear all the expenses of such litigation and be entitled to retain all recoveries, and Mid-Continent and Minneapolis jointly and severally agree that in the event any such suit is brought by both parties jointly, the expenses of litigation and/or recoveries therefrom shall be equally shared by the parties and Mid-Continent reserves the right to join and participate in any suit which may be brought by Minneapolis on the aforesaid patents and to share in the expense and recovery thereof. In the event Minneapolis brings any such action in the name of Mid-Continent then Minneapolis shall protect Mid-Continent from all costs, expenses and/or damages which accrue against Mid-Continent on account of or growing out of any such action.

11. Minneapolis shall have the right to terminate this agreement on December 31st of any year during its continuance by previous notice thereof in writing, mailed postage prepaid, not later than the first day of November next preceding to Mid-Continent, addressed to its last
865 known place of business, whereupon this License Agreement shall cease and all rights and liabilities of Minneapolis shall terminate without prejudice to any rights of Mid-Continent to recover any moneys then due by way of royalties prior to such termination.

12. Minneapolis agrees that, in the event Minneapolis shall grant any sub-licenses hereunder, each sub-license shall be so restricted as to terminate simultaneously with the termination of this License Agreement.

13. Minneapolis agrees that it will comply with the United States Patent Statutes with respect to the marking of said switches made and sold under this License with the word "Patent" and the number or numbers of the patents applicable thereto and will insert such requirement in each sub-license granted by it.

14. If the royalties herein provided shall at any time be in arrear for thirty (30) days after they shall become due, or if Minneapolis shall make any default in performing any of the agreements herein contained, then, and in any such case, Mid-Continent shall have the right by notice in writing mailed Minneapolis, postage prepaid to its last known place of business, to revoke this License, which shall become void the thirtieth (30th) day thereafter unless Minneapolis shall have previously remedied such default or arrear, without prejudice to any right of action or remedy of Mid-Continent for the recovery of any moneys then due and accrued to the date of cancellation, to Mid-Continent hereunder, or in respect of any antecedent breach of any agreement herein contained.

15. If the Cross patent No. 1,758,146 shall be adjudicated by a court of competent appellate jurisdiction or by a trial court from which no appeal is taken, invalid or shall be thereby so restricted in its scope as to be of no practical benefit to Minneapolis by way of preventing unlicensed competition, then, and in either such event, Minneapolis shall have the right, upon notice in writing mailed postage prepaid addressed to Mid-Continent at its last known place of business, to discontinue any and all further royalty payments hereunder and thereupon this contract shall terminate.

866

16. Mid-Continent covenants that it has the full right and authority to make this agreement and that it will not make any agreement or do any act in derogation or contravention of any right hereby granted Minneapolis.

17. Minneapolis agrees that it will not contest the validity of either of the above-recited patents during the existence of this License Agreement and agrees that it will during the existence of this License Agreement, assist Mid-Continent in upholding the validity of said patents.

18. This License Agreement shall inure to the benefit

of the successors and/or assigns of the parties hereto provided such successors and or assigns shall agree to, and accept, the obligations and liabilities of such predecessor and/or assignor.

In Witness Whereof, the parties hereto have caused this Agreement to be signed by their respective duly authorized officers and their respective corporate seals to be affixed.

November 1, 1938.

Mid-Continent Investment Company, Inc.
By Forbes Cross,
*President.*

Attest:
Walter M. Cross, Jr.,
*Secretary.*

November 7, 1938.

Minneapolis-Honeywell Regulator Company.
By Charles B. Sweatt.

Charles C. Buckland,
*Secretary.*

867 State of Missouri, }
County of Jackson. } ss.

On this 1st day of November, 1938 before me, appeared Walter M. Cross Jr., to me personally known, who, being by me duly sworn did say that he is secretary of Mid-Continent Investment Company, Inc., and that the seal of the foregoing instrument is the corporate seal of said corporation, and that said instrument was signed and sealed in behalf of said corporation by authority of its Board of Directors, and said secretary acknowledged said instrument to be the free act and deed of said corporation.

(Sgd.) Trixie Smith,
*Notary Public, Jackson County Missouri.*

My commission expires Oct. 6, 1940.

State of Minnesota, }
County of Hennepin. } ss.

On this 7th day of November, 1938, before me, appeared Charles C. Buckland, to me personally known, who being by me duly sworn, did say that he is the Secretary of Minneapolis-Honeywell Regulator Company, that the seal affixed to the foregoing instrument is the corporate seal of said corporation, and that said instrument was executed in behalf of said corporation by authority of its Board of Directors; and said Secretary acknowledged said instrument to be the free act and deed of said corporation.

(Sgd.) Ruby E. Pfaff,
*Notary Public, Hennepin County, Minnesota.*

My commission expires May 2, 1942.

**Plaintiff's Exhibit 10**

**BULLETIN No. 241-A**

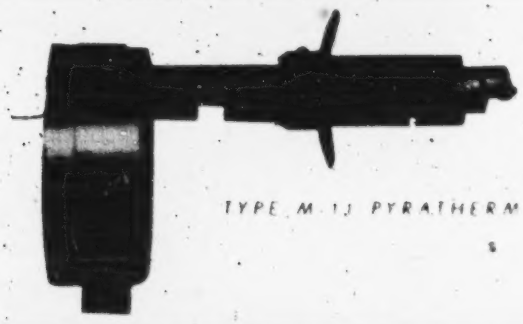
# MERCOID STOKATHERM CONTROL SYSTEM

REGISTERED TRADE MARK

Patents Issued 1,598,874 - 1,640,849 - 1,701,989 - 1,742,181 - 1,757,834 - 1,971,921 - (other) Patents

**LISTED AS STANDARD BY UNDERWRITERS' LABORATORIES, INC.**

TYPE TJ-V STOKATHERM



TYPE M-11 PYRATHERM

## A NEW STOKER CONTROL SYSTEM

### *Incorporating the following important features:*

**FIRE MAINTAINING**

The Stokatherm System operates the stoker for only the very shortest periods necessary to maintain a minimum fire while the thermostat is in the off position.

The firing periods are not at definitely timed intervals or governed by fixed stack temperatures, but are automatically regulated to meet the variable conditions encountered on each installation. As domestic stokers operate approximately 80% of the heating season on the fire maintaining controls, the economical, short operations of the Stokatherm not only result in a very decided fuel saving, but also insure against overheating.

**AUTOMATIC COMPENSATION FOR VARIATIONS IN FUEL**

If the fuel delivered to the stoker should have a higher or lower burning rate than that formerly used, the Stokatherm System automatically compensates for this and changes its firing period accordingly. This eliminates service due to overheating or out-fire.

**OUT-FIRE OPERATION**

Should the fuel become exhausted, or the fire go out, the Stokatherm System automatically stops the stoker. This prevents operating an empty stoker and guards against filling the combustion chamber with unburned fuel, a condition most unpleasant to the operator.

**RUGGED CONSTRUCTION, EASY TO INSTALL.**
**LOWER SERVICE EXPENSE TO THE DEALER,**
**INCREASED ECONOMY TO THE USER.**

LIST PRICES

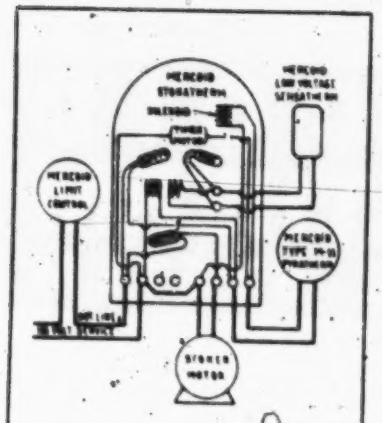
TYPE TJ-V STOKATHERM, 110 OR 220 VOLT, 60 CYCLE - $39.50 TYPE M-11 PYRATHERM $12.50

**THE MERCOID CORPORATION**

SOLE MANUFACTURERS THE MERCOID SWITCH

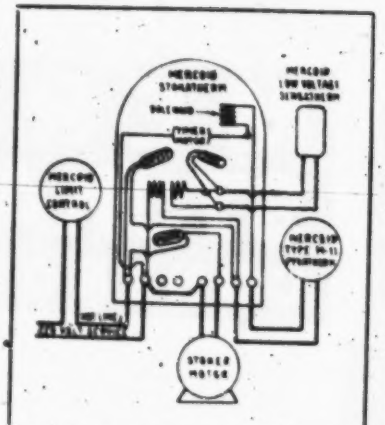
4201 BELMONT AVENUE ● CHICAGO, ILLINOIS, U. S. A.

# WIRING DIAGRAMS.



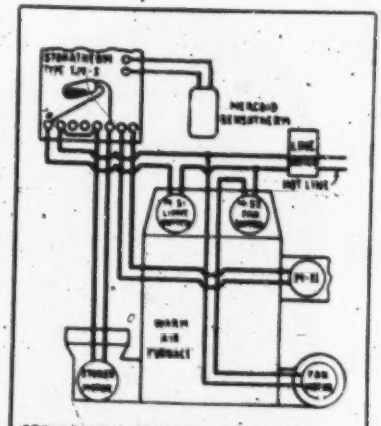
STOKATHERM CONTROL WIRING FOR SINGLE PHASE 110 VOLT MOTORS

No. 7



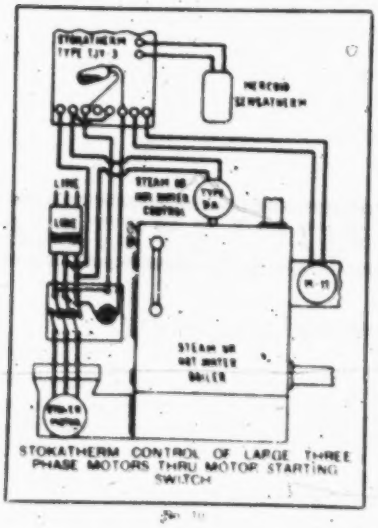
STOKATHERM CONTROL WIRING FOR SINGLE PHASE 220 VOLT MOTORS

No. 8



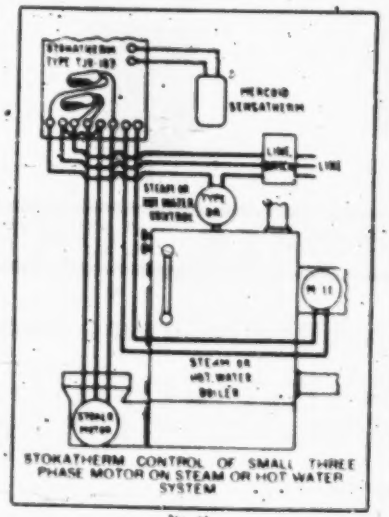
STOKATHERM CONTROL OF SINGLE PHASE MOTOR AND CIRCULATING FAN ON WARM AIR SYSTEM.

No. 9



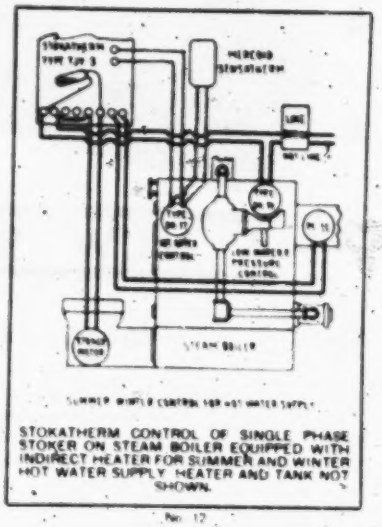
STOKATHERM CONTROL OF LARGE THREE PHASE MOTORS THRU MOTOR STARTING SWITCH

No. 10



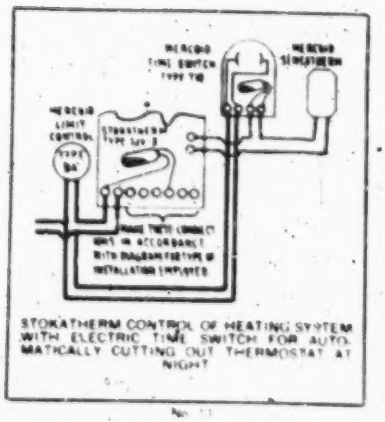
STOKATHERM CONTROL OF SMALL THREE PHASE MOTOR ON STEAM OR HOT WATER SYSTEM

No. 11



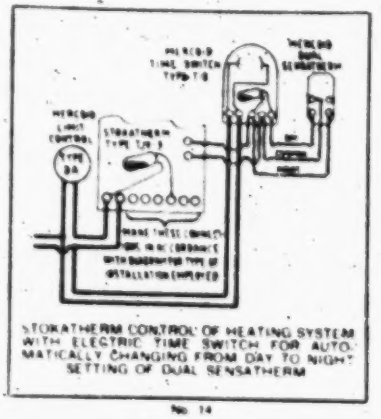
STOKATHERM CONTROL OF SINGLE PHASE STOKER ON STEAM BOILER EQUIPPED WITH INDIRECT HEATER FOR SUMMER AND WINTER HOT WATER SUPPLY HEATER AND TANK NOT SHOWN.

No. 12



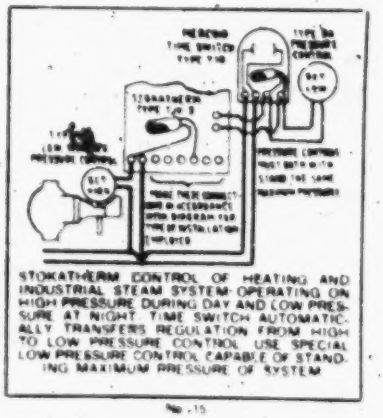
STOKATHERM CONTROL OF HEATING SYSTEM WITH ELECTRIC TIME SWITCH FOR AUTOMATICALLY CUTTING OUT THERMOSTAT AT NIGHT

No. 13



STOKATHERM CONTROL OF HEATING SYSTEM WITH ELECTRIC TIME SWITCH FOR AUTOMATICALLY CHANGING FROM DAY TO NIGHT SETTING OF DUAL SENSATHERM

No. 14



STOKATHERM CONTROL OF HEATING AND INDUSTRIAL STEAM SYSTEM OPERATING ON HIGH PRESSURE DURING DAY AND LOW PRESSURE AT NIGHT. TIME SWITCH AUTOMATICALLY TRANSFERS REGULATION FROM HIGH TO LOW PRESSURE CONTROL. USE SPECIAL LOW PRESSURE CONTROL CAPABLE OF STANDING MAXIMUM PRESSURE OF SYSTEM

No. 15



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# INSTALLATION INSTRUCTIONS

**INSTALLING TYPE TJ-V STOKATHERM**—Carefully select an accessible and firm location in the vicinity of the stoker, preferably on a wall or column free from vibration.

Place the control at the location desired and with a pencil circle the three mounting holes. The top two holes have bayonet slots to simplify mounting. Remove the control and install the top two screws, but do not draw up tight. Hang the control on the top two screws, and after LEVELING install the bottom screw and tighten the top screws.

**INSTALLING TYPE M-11 PYRATHERM**—Choose the location with care. The usual location is about two feet from the furnace, on the most convenient side of the stack.

Cut a 1⅝" hole directly on the side of the stack so that the instrument stem is horizontal when mounted. Fasten the flange around the hole and insert the stem so that the three rings on the extension sleeve are visible.

BE SURE THE INSTRUMENT IS LEVEL, before tightening the flange set screw. This can be determined by sighting across cover screws, seeing that they are horizontal.

**WIRING**—Check nameplate on Stokatherm and see that cycle and voltage correspond with the current used. Be sure the connected load is within the motor rating of the control. Wire in accordance with diagrams in the cover, or if special hook-ups are desired, then in accordance with diagrams shown on page to right.

Do not attempt to make any external transformer connections in the Sensatherm circuit as the Mercoid Transformer Relay induces its own low voltage.

If large stoker motors requiring starting switches are used, the STOKATHERM may be used to control the pilot circuit of the starting switch. See cover diagram No. 21 or 23. When connected in the pilot circuit, the motor switch terminal having the red tipped end must be removed from terminal post No. 1 and connected to terminal post No. 3.

RIGID CONDUIT MUST NOT BE ATTACHED DIRECTLY TO PYRATHERM OR BOILER LIMIT CONTROLS. Use a short strip (6 or 8 in.) of BX cable between control and conduit. If rigid conduit connections are made, expansion and contraction strains are very apt to break control connection at boiler.

Careless terminal connections are often responsible for service trouble. Scrape and clean wire and carefully place around terminal screw in the direction the screw turns. (See illustration No. 5.)

Illustration No. 5

Use two-wire armored low voltage cable between the Mercoid Sensatherm and the thermostat terminals of the relay. Bring the low voltage cable through the brass bushing "G" (see illustration No. 3) and securely attach wires to the terminals marked "Thermostat." Pull out excess cable and firmly clamp cable in bushing "G" by means of screw provided.

## OPERATING INSTRUCTIONS

If stoker has stopped due to fire's going out, rekindle fuel and start stoker by pushing the reset button "R". (Illustration No. 6.) If fire has gone out while fuel still remains in the hopper, it may be necessary to change adjustment "B" to a shorter period.

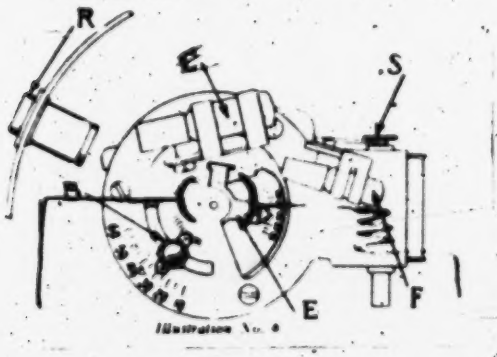


Illustration No. 6

A normal adjustment of "B" is 30 minutes as set at the factory. This adjustment is usually satisfactory, unless a fast burning coal such as Lignite, is used for which a shorter adjustment may be needed. On heavy coals a longer adjustment should be used to obtain the greatest economy. Excessive fire box temperatures during long periods of maintaining fire, as in mild weather, indicate that adjustment "B" is too short, or that Pyratherm M-11 has its bimetal coil drawn too far into the mounting flange sleeve, so that the bimetal does not quickly respond to increases in temperature. To correct this condition readjust M-11 Pyratherm in its mounting flange so that only two rings on the extension sleeve are visible. If overheating continues readjust M-11 so that only one ring on extension sleeve is visible.

Out-fire adjustment "E" is set at the factory for 30 minutes, and need not be decreased unless a very high rate of fuel feeding is used, in the stoker installation. The adjustment limits the amount of unburned fuel that can be conveyed into the combustion space, or the period of time the stoker can operate without fuel.

**When adjustments are made power supply must be "off".**

## NOTES FOR SERVICE MEN

1. Tube "C" is outfire switch.
2. Tube "F" is fire-maintaining switch.
3. Tube "D" is motor switch.
4. The complete Stokatherm System is inoperative when tube "C" is in the off position. This would occur if the fuel should become exhausted. It may also occur due to either adjustment "B" being set at too wide an interval, in which case the adjustment must be shortened, or to the M-11 Pyratherm being improperly positioned in the mounting flange.
5. Tube "F" is in parallel with thermostat. When in the "on" position the stoker operates. This switch is operated only by the timer motor.
6. The tube in the M-11 Pyratherm must be in the "on" position for timer to run. This tube will assume its proper position when the fire is kindled.
7. For satisfactory operation the M-11 Pyratherm is usually set with three rings visible for high temperature stacks, two rings visible for medium temperature stacks, and only one ring visible on low temperature stacks.
8. The timer motor does not run during the period that the thermostat calls for heat and normally operates the stoker.
9. When timer motor is running, plunger "S" is in the up position. When timer motor is not energized, plunger "S" is in the down position.
10. When the thermostat calls for heat it immediately takes command of the stoker operation. The timer mechanism continues its cycle of operation only until the Pyratherm circuit opens.
11. The timing mechanism always returns to the starting position, on a current interruption, or on a rise in stack temperature sufficient to move the tube in the stack control to the open position.
12. Operation of the timer can be tested without waiting for the entire Fire Maintaining Period to elapse. This can be accomplished by lifting up on adjustment "E" until switch "F" almost makes contact. The timing mechanism in completing the cycle will close this circuit. In making this test the power must be on, the thermostat must be in the "off" position, and the Pyratherm tube and outfire tube "C" must be in the closed position. DO NOT ATTEMPT TO OPEN TUBE CIRCUIT "F", by pushing downward on this tube or by pushing down on adjustment "E", as in either case the mechanism may be strained. To open tube circuit "F", push down on plunger "S" or interrupt power supply.

## CAUTION

HAVE YOU READ DESCRIPTION OF OPERATION AND INSTRUCTIONS CAREFULLY?

KEEP INSTRUMENT COVERS CLOSED.

DO NOT OIL ANY PARTS.

DO NOT OVERLOAD—See rating on nameplate.

DO NOT ATTEMPT TO DISCONNECT OR CHANGE ANY PARTS.

# MERCOID STOKATHERM

## STOKER CONTROL PROGRESS

For many years manually controlled chain grate or underfeed stokers were employed on industrial installations. As underfeed stokers were developed in smaller sizes to meet the requirements for industrial and commercial steam heating equipment, there was an increasing demand for controls to eliminate a great amount of the manual attention required, by automatically controlling the steam pressure. This demand was easily met by the adaptation of standard pressure limit controls.

During the past few years small size stokers for domestic heating plants have been introduced and accepted in ever increasing volume. To meet the competition of other automatic heating equipment it was necessary to provide thermostatic room temperature regulation. A new problem arose, as it became necessary to provide means to keep the fire from going out during the long periods, especially in mild weather, when heat is not required and the thermostat remains in the off position. Controls were not available, which had been designed especially to meet the many variable conditions encountered on domestic stoker installations. As a result it was necessary, at the time, to employ standard controls, developed for other applications, and modify them in the best possible manner to meet stoker requirements. Two methods were adopted; one operating the stoker at definitely timed intervals, and the other at fixed stack temperatures or boiler water temperatures.

Timers (with or without a delay after the thermostat is satisfied) fire the stoker at fixed intervals for a predetermined period. In mild weather, when for prolonged periods the thermostat does not call for heat, timers must be set to operate long enough to feed a sufficient amount of fuel to maintain combustion. During colder seasonal periods when the thermostat operates at short intervals the amount is greatly in excess of the quantity required merely to maintain combustion, and is likely to cause overheating and a consequent waste of fuel. The operating period of the timer can be decreased to meet this condition and prevent overheating, however, when mild weather again prevails, the fire may then go out due to the fire maintaining period being too short. This seasonal changing of the timer setting results in unnecessary service expense. Furthermore, ordinary types of timers employ no outfire feature or protection against the stoker's operating without fuel, or filling the combustion chamber with unburned fuel—either of which is a most annoying and undesirable condition.

The other method of controlling stoker operation has been through the use of a stack control; which stops and starts the stoker at predetermined low stack temperatures. A somewhat similar method has been used on steam boilers, whereby the periods of operation of the stoker are determined through the temperature of the boiler water instead of through the temperature of the flue gases. As this method was adaptable only on steam installations, the stack type control became more popular. Stack controls usually employ metal elements which expand and contract with stack temperature changes and actuate the controls. It sometimes happens that these actuating elements are subjected to excessive temperatures and corrosive flue gases. Under such abnormal conditions these elements are apt to change and take a set or what is known as a metal "growth." This changes the original calibration of the control and results in overheating, consequent waste of fuel, and the expense of servicing to recalibrate the control.

Several years' intensive study of the needs of the stoker field has resulted in the development of a control system that fully meets all requirements. The MERCOID STOKATHERM SYSTEM based on a new principle of operation effectively combines the advantages of Timer and Stack Controls, and at the same time overcomes the former weaknesses and disadvantages of these devices.

It is important that fire be maintained during the periods when the thermostat does not call for heat. Further, it is important that during this period the fire be maintained economically, so that excessive amounts of fuel are not consumed when heat is not required.

The Stokatherm system operates the stoker for only the shortest periods necessary to maintain a minimum fire while the thermostat is in the "off" position. The firing periods are not at definitely timed intervals or governed by fixed stack temperatures, but are automatically regulated to meet the variable conditions encountered on each installation. During approximately 80 per cent of the heating season stokers operate on the fire maintaining controls. The economical, short operations of the Stokatherm not only result in a very decided fuel saving, but also insure against overheating. Should the fuel delivered to the stoker, have a higher or lower burning rate than that formerly used, the Stokatherm system automatically compensates for this and changes its firing period accordingly. Should the fuel become exhausted or the fire go out, the Stokatherm system automatically stops the stoker. This prevents running the stoker unnecessarily, and guards against filling the combustion chamber with unburned fuel.

## CONSTRUCTION DETAILS OF STOKATHERM

The Mercoid Stokatherm System consists of several units operating in conjunction. The Sensatherm and boiler limit control are in command of the stoker's operation when heat is required. When heat is not required the Stokatherm and Pyratherm maintain the fire. These units also act to stop the stoker should the fire go out.

Type T.T.V Stokatherm
Illustration No. 1

**TIMER**—The timer is actuated by a positive self-starting Waltham synchronous motor movement of the highest quality, with heavy cut brass wheels having pinions of hardened and polished tool steel.

**MERCOID TRANSFORMER RELAY**—The Mercoid Transformer-Relay incorporated in this control is a very simple and compact device, which is in principle a low voltage transformer but also operates as a repulsion-relay.

Two independent insulated coils are mounted on a laminated iron yoke. The primary coil is fixed in position and is connected across the high voltage line. The secondary coil is movable and is connected to the low voltage thermostat circuit. These two coils act as a transformer and low voltage is induced in the secondary coil when the primary coil is energized. When the low voltage thermostat circuit is closed, the secondary coil instantly moves to the right, due to the repulsion action of the coils, and starts the stoker by closing the motor switch circuit "D".

As this transformer relay does not employ the conventional clapper type iron armature, rattling noises due to uneven, dirty or rusty armature faces, cannot occur. Furthermore, there can be no residual magnetism to affect the operation as there are no metal contacting surfaces.

**MERCOID MERCURY SWITCHES**—Mercoid mercury contact switches are used thruout. These switches, with their hermetically sealed mercury contacts, are immune to oxidation, dirt or corrosion. Burning, pitting and sticking—sources of service trouble and expense with open-to-air contacts—cannot occur with the sealed Mercoid switch. The contact remains

# CONTROL SYSTEM FOR

permanently clean and the free flowing mercury insures perfect electrical contact at every operation.

**STEEL HOUSING**—The steel housing has an attractive black crystal finish. It has a gasketed dust-tight hinged cover, with door opener which can be sealed or padlocked. Back of case has three embossings: one with regular hole, and two with bayonet slots, to simplify installation. Three screws are provided for fastening to wall.

Height 12 in., Width 6½ in., Depth 3½ in.—Shipping weight—approximately 10 pounds.

**SIMPLIFIED WIRING**—Knockouts are provided on back, bottom and both sides of the case, for BX or conduit wiring. Terminal posts are accessible and ample room is provided for wiring.

**ADJUSTMENTS**—Adjustments are provided to meet variations in the operating characteristics of different types of stokers. When the proper adjustments have been determined for a particular type of stoker, these same adjustments can be employed on all installations whether steam, hot water or warm air. Only if conditions are very abnormal is a change in adjustment required on any installation.

When the thermostat is satisfied and the stoker stops, the stack temperature gradually drops, and in response to this decrease in stack temperature, the M-11 Pyratherm (explained below) closes its circuit. This energizes both timing motor "M" and solenoid "S" in the Type TJ-V unit.

When solenoid "S" is energized, its plunger rises and engages the front gear mechanism with the motor movement. After the time as set by the FIRE MAINTAINING ADJUSTMENT "B" has elapsed, circuit "F" closes and operates relay "T" which starts the stoker. As soon as the fire responds, causing a slight increase in stack temperature, the Pyratherm opens the circuit to the timing motor and stops the stoker.

Should the fire be out, the stack temperature does not rise to open the Pyratherm circuit. The stoker then continues to operate for the period set by the OUT-FIRE ADJUSTMENT "E". At the end of this period switch "C" opens its circuit and stops the stoker.

## TYPE M-11 PYRATHERM

The M-11 Pyratherm is radically different from conventional stoker stack controls, as it does not operate at pre-determined high and low temperature settings, but operates only on a differential or change in temperature.

*Type M-11 Pyratherm*
*Illustration No. 4*

On an increase in temperature the circuit immediately opens, regardless of the temperature existing in the stack at the time. Regardless of how high the temperature may continue to rise, the unique Mercoid ratchet assembly provided permits the bimetal coil to turn without strain.

On a decrease in temperature the circuit immediately closes, regardless of the temperature existing in the stack at the time. The ratchet assembly again relieves the bimetal coil from strain regardless of how low the temperature may go.

This instrument, operating by means of the ratchet assembly on a differential in temperature, differs from conventional stoker stack controls, in that it remains in perfect adjustment, regardless of changes or "sets" in the bimetal coil, due to excessive temperatures or corrosive flue gases. For this reason, no protecting well is required over the bimetal coil.

**OPERATION OF STOKATHERM SYSTEM**—In order to clarify the description of the operation of the Mercoid Stokatherm Control System, we are assuming normal conditions as encountered in the average domestic stoker burning a fair grade of bituminous coal. Under such conditions, the normal setting of the fire maintaining adjustment "B" is 30 minutes and the out-fire adjustment "E" is 30 minutes. For large domestic or industrial stokers, these adjustments must necessarily be changed, as covered in a later paragraph under heading "Operating Instructions."

**NORMAL OPERATION — SENSATHERM CALLING FOR HEAT**—When the Sensatherm calls for heat the relay "T" operates and closes switch circuit "D" which in turn causes the stoker motor to operate. As the fire builds up the stack temperature continues to rise. The maximum stack temperature attained varies on different installations as it is dependent upon the feeding rate of the stoker, the construction of the boiler, and the period of time the stoker continues to operate. As soon as the stack temperature starts rising the M-11 Pyratherm opens its circuit. The bimetal coil continues to turn until the maximum stack temperature is reached. No strain is placed on this coil as the temperature continues to rise, as the gravity locking mechanism of this instrument permits free movement through a toothed ratchet wheel. When the maximum stack temperature has been attained, there is no further movement of the bimetal coil and the switch circuit remains in the open position as long as the thermostat continues to call for heat.

**FIRE MAINTAINING — SENSATHERM CIRCUIT OPEN**—When the Sensatherm opens its circuit due to the room's being at the required temperature, the Mercoid Relay "T" instantly opens its circuit and stops the stoker. The fire now starts dying down and the stack temperature decreases accordingly. As this decrease in stack temperature occurs, the bimetal coil of the M-11 Pyratherm starts turning and the first movement causes the switch circuit to close. The closing of this circuit energizes motor "M" and solenoid "S." The Stokatherm timing motor is now in operation and within the period as set by adjustment "B," which we have assumed at 30 minutes, switch "F" closes its circuit and operates the relay, which, in turn, again starts the stoker.

UNDER NO CIRCUMSTANCES CAN THE STOKER OPERATE IN LESS THAN 30 MINUTES AFTER THE THERMOSTAT SHUTS OFF, DURING THIS 30 MINUTE DELAY PERIOD, THE STACK TEMPERATURE CONTINUES TO DECREASE. On the average installation the stack temperature drops several hundred degrees during this first thirty minute period, and the Pyratherm accordingly follows this change. Regardless of how low the temperature may drop, only a slight rise in stack temperature is necessary to open the Pyratherm circuit.

If the fire is in good condition, as is normally the case during the first fire maintaining operation after the thermostat shuts off, the stoker operates for only a very short period (usually from 10 to 15 seconds), until the stack temperature rises and opens the Pyratherm circuit, which immediately stops the stoker. As the Pyratherm circuit opens, timer motor "M" stops, and as solenoid "S" is deenergized the movement gear train releases and immediately returns to its normal starting position.

As the stoker is now not operating, the stack temperature starts decreasing and the M-11 Pyratherm accordingly again closes its circuit. This causes the Stokatherm mechanism to start operating and another test of the condition of the fire will again be made when another thirty minute delay period has elapsed. During this thirty minute period, the fire continues to die down and the stack temperature lowers accordingly. As soon as the Stokatherm starts the stoker, the M-11 Pyratherm performs its most important function in maintaining a low and even fire bed. THE CONDITION OF THE STOKER FIRE IS ACCURATELY INDICATED BY THE RATE AT WHICH THE STACK TEMPERATURE RISES AS THE STOKER BLOWER STARTS OPERATING. If a fast burning coal has been employed the fire may now be very low. Regardless of the condition of the fire, the M-11 Pyratherm permits the stoker to operate only until there is a response from the fire as is indicated by the rise in stack temperature. If the fire is in good condition, the period of operation will be very short (10 or 20 seconds), but should the fire be low the period of operation is increased accordingly until the fire responds and the stack temperature rises.

The M-11 Pyratherm continues periodically to check the condition of the fire as above outlined, until the fire reaches the lowest point at which combustion can be sustained. Operation at this low point now continues with the stoker using a minimum amount of fuel, until the thermostat again calls for heat. This system is so sensitive while maintaining a minimum fire, that it automatically compensates even for changes in basement air temperature or boiler water temperature. The stack temperatures may fluctuate considerably during such changes, but only sufficient fuel is fed to maintain a minimum fire.

The firing periods are not at definitely timed intervals or at fixed stack temperatures, as this control system automatically regulates the firing periods to meet the variable conditions encountered on each installation. The stoker operates for only the very shortest periods necessary to maintain the fire during the time the thermostat is in the off position. This not only results in a very decided saving in fuel, but also insures against overheating. The feature of automatically compensating for the vari-

# AUTOMATIC STOKERS

ables encountered on each installation eliminates unnecessary servicing. If a new supply of fuel delivered to the stoker has a faster or slower burning rate than that previously used, the Stokatherm system, being directly responsive to the condition of the fire, automatically varies the amount of fuel supplied accordingly. This eliminates servicing due to overheating or out-fire.

**OUT-FIRE OPERATION—FIRE EXTINGUISHED**—Should the fuel become exhausted, or the fire go out, the stack temperature lowers, causing Pyratherm M-11 to close its circuit and actuate the Stokatherm mechanism. Even though the thermostat is in the "on" position calling for heat, the Stokatherm mechanism operates, and when the out-fire period governed by adjustment "E" has expired (normal setting 30 minutes), switch "C" opens its circuit and stops the stoker. When the fire has been rekindled the stoker may again be started by pressing hand reset button "R."

**AUTOMATIC RESET OF STOKATHERM MECHANISM**
When the Sensatherm calls for heat, it immediately takes command and operates the stoker. At this time the Stokatherm mechanism may be at any point in its cycle of maintaining the fire. The Stokatherm mechanism, however, does not stop at any intermediate point in its cycle, but is automatically reset to the normal starting position by the Pyratherm. This insures satisfactory operation as the Stokatherm then goes through its complete cycle the next time this instrument is called upon to operate.

Automatic reset of the Stokatherm mechanism is accomplished through the rise in stack temperature which follows after the Sensatherm places the stoker in operation. The Pyratherm responds to this rise in stack temperature and opens its circuit. As this circuit opens, timer motor "M" stops, and as solenoid "S" is deenergized the movement gear train releases and immediately returns to its normal starting position.

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## Additional Controls Required to Complete the Mercoid Stokatherm System

The Mercoid Stokatherm and Pyratherm make up only part of a complete Stokatherm system. Satisfactory operation can be assured only when the system is completed by the use of the Mercoid Sensatherm and Mercoid limit controls. These instruments have operating characteristics which coordinate with the operation of the Stokatherm and provide assurance of positive and satisfactory stoker performance.

All switches in Mercoid controls are of the hermetically sealed mercury contact type. They cannot be affected by dust, dirt, or corrosive gases. The contacting surfaces remain clean under all operating conditions.

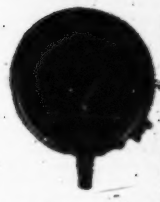
### MERCOID SENSATHERM

The Mercoid Sensatherm is a thermostat of beauty and mechanical perfection. It is extremely sensitive and maintains a uniform room temperature without the use of any artificial stimulation. It operates on a differential of one degree (plus or minus ½ degree) and is adjustable to meet special requirements.

Dual Sensatherms are also available for day and night temperature regulation. When employed with the Mercoid-Triplex electric time switch, no winding or attention whatsoever is required in changing from day to night setting.

Write for bulletin No. 100A.

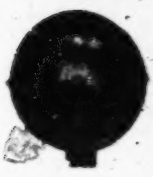
### MERCOID TYPE DA-31 STEAM CONTROLS



Mercoid Type DA-31 steam controls are furnished with convenient outside double adjustments for independently setting the cut-in and cut-out pressures. They are equipped with a visible and accurately calibrated dial. No calculations are necessary to determine the operating points,—the indicators accurately show on the dial the pressures at which the instrument is set to operate. Very close differentials can be obtained, and wide range adjustments are provided. Sealing or locking means provided as standard to prevent tampering.

Available in ranges from 30" vacuum to 300 lbs. pressure.
Write for bulletin No. C-65.

### WARM AIR FURNACE CONTROLS



The Mercoid Type M-51 control is used to protect warm air furnaces against over-heating. It has a dial calibrated from 50 to 650 deg. F. Double adjustments are provided for easily setting both the cut-in and cut-out temperatures. An indicator shows the temperature in the furnace bonnet.

Type M-53 is similar in construction to Type M-51. It is used to control the operation of warm air furnace circulating fans.

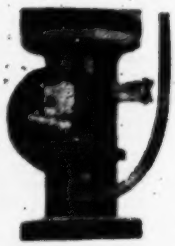
### HOT WATER BOILER CONTROLS

#### Immersion Type Control

These Controls have proven their unfailing accuracy and durability over years of service, to be the correct type of automatic limiting device for coal stokers operating on hot water boilers and vapor-vacuum systems. There is no lag in the operation as is encountered with controls mounted on the outside of boiler or risers.

Type DA-36 has the same outside adjustments as described under DA-31. No other control provides such desirable features for control of hot water boilers, hot water storage tanks, indirect water heaters on steam boilers or close pressure regulation of vapor-vacuum systems. Both straight and back angle types are available. Write for bulletin No. C-65.

#### Surface Type Control



Where circumstances require temperature control by surface contact, the Fig. 35 Mercoid Risertherm is recommended. This limiting control is clamped on the risers of hot water heating systems or on the surface of hot water tanks. It is especially recommended for old jobs where it would be difficult to remove the boiler plug for installation of the immersion type control.

This instrument employs features which make it positive in action and very sensitive to temperature changes.

Write for bulletin No. 220-A.

### MERCOID COMBINED PRESSURE AND LOW WATER CONTROL TYPE DA-71

This control has the new double adjustment feature. It is designed primarily for the protection of automatically fired steam boilers, to prevent the hazard of firing into dry boilers and also guard against building up excess steam pressure. This Bourdon tube equipped control has proven its efficiency and durability on thousands of installations. Ranges are available up to 300 pounds.

Write for bulletin No. C-65.

# MERCOID SWITCHES

Plaintiff's Exhibit 11

FIG. 9-81S

FIG. 9-81P

FIG. 9-81 MAGNETIC SWITCH

PERMANENT MAGNET PP 93-148

MOUNTING CLIP FIG. 7-88

MOUNTING CLIP FIG. 7-87

Mercoid switches have operated for years in hundreds of thousands of Mercoid Automatic controls, and have become universally known for their unfailing performance under the most exacting field requirements. They are now available for commercial and industrial applications requiring positive and dependable electric contacts. The Mercoid hermetically-sealed mercury contact switch is not affected by dust, dirt or corrosion. The contact is instantaneous and silent in operation, remains permanently clean, and will operate indefinitely without deterioration.

To obtain full advantage of the highly desirable features of the Mercoid switch, manufacturers are requested to submit their problems to our Engineering Department and obtain the benefit of their years of experience in the application of these switches.

**FIG. 9-81**

**Fig. 9-81** is a mercury to mercury contact switch. One electrode terminates in a pool of mercury within a cup of high temperature refractory material. The other electrode is submerged in the main body of mercury, and as the switch is tipped these two pools of mercury join and close the circuit. Even when operated very slowly, the contact opens or closes with a positive and instantaneous action as the mercury joins or divides. The electric arc is confined to the lip of the high temperature refractory cup, so that no deterioration can occur.

**ELECTRICAL CAPACITY:** Either A.C. or D.C., 10 amp.-110V., 5 amp.-220V., 3 amp.-440V.

**FIG. 9-81**

**Fig. 9-81** is a mercury to electrode type switch. Two electrodes and a quantity of mercury are hermetically sealed within the glass switch. By tipping the switch so that the mercury flows to the contact end, the circuit is closed between the electrodes.

**ELECTRICAL CAPACITY:** Either A.C. or D.C., 4 amp.-110V., 2 amp.-220V., 1 amp.-440V.

**FIG. 9-81**

**Fig. 9-81** is a magnetically operated mercury contact switch. This switch remains fixed in position and operates by magnetic attraction thru the glass. It is particularly recommended for use with scientific apparatus, automatic scales, photo-electric apparatus, automatic vending machines, etc. where a positive contact is required but very little actuating power available.

**ELECTRICAL CAPACITY:** 9-10 amp. at 24 volts or less. On 110 to 220 volts either A.C. or D.C. the maximum capacity is 25 watts.

Permanent magnet PP 93-148 can be furnished complete with mounting parts. This magnet is of the highest quality magnetic steel, and is of the correct size for operating the Fig. 9-81 switch.

## MERCOID SWITCH LEAD WIRES, CLIPS, ETC.

All Mercoid switches can be furnished with straight leads as shown on Fig. 9-51S, and when so desired the letter "S" should appear on order after the figure number of switch desired. Letter "R" designates reversed leads, as shown on Fig. 9-81R.

Standard flexible leads are 7 in. long with No. 8 ring terminals. Various types of lead wires are available and can be furnished in any lengths desired, and either with or without ring terminals.

The illustrations to the left show several standard nickel silver mounting clips. Many other styles are available, to meet various requirements.

| Fig. No. | SPECIFICATIONS | LIST PRICE |
|---|---|---|
| 9-51 | 10 Ampere | $2.10 |
| 9-81 | 4 Ampere | 1.15 |
| 9-81 | Magnetic Type | 2.25 |
| 93-148 | Magnet | .50 |
| 7-88 | Clip for 9-81 Switch | .08 |
| 7-87 | Clip for 9-81 Switch | .08 |
| 7-187 | Clip for 9-81 Switch | .08 |

**Many standard Mercoid switches are available other than those listed above. For complete information, write for Bulletin 500A.**

**Special net prices quoted to manufacturers requiring switches and clips in quantities.**

## PATENT NOTICE

**Mercoid Controls are manufactured and sold under the following patents:**

| | | | | | |
|---|---|---|---|---|---|
| 1,473,120 | 1,648,390 | 1,690,089 | 1,757,970 | 1,869,603 | 1,904,378 |
| 1,589,380 | 1,648,414 | 1,691,016 | 1,762,180 | 1,872,070 | 1,908,702 |
| 1,598,874 | 1,657,661 | 1,697,988 | 1,777,887 | 1,881,321 | 1,909,371 |
| 1,521,638 | 1,658,013 | 1,705,989 | 1,786,018 | 1,882,613 | 1,915,693 |
| 1,581,474 | 1,662,122 | 1,723,756 | 1,805,589 | 1,882,614 | 1,922,698 |
| 1,612,777 | 1,674,051 | 1,733,615 | 1,817,634 | 1,884,045 | 1,923,680 |
| 1,614,621 | 1,674,601 | 1,734,015 | 1,817,635 | 1,884,046 | 1,923,681 |
| 1,636,161 | 1,675,897 | 1,734,016 | 1,824,612 | 1,889,44- | 1,924,670 |
| 1,640,889 | 1,675,899 | 1,734,017 | 1,834,287 | 1,889,448 | 1,926,394 |
| 1,642,932 | 1,681,421 | 1,737,859 | 1,834,288 | DES. 87,669 | 1,934,200 |
| 1,642,937 | 1,698,276 | 1,745,179 | 1,834,289 | DES. 96,562 | 1,938,094 |
| 1,644,936 | 1,698,280 | 1,752,967 | 1,853,444 | 1,901,40- | 1,949,915 |
| 1,648,399 | 1,697,847 | 1,757,439 | | | 1,960,179 |

2,003,143
2,004,897

**OTHERS PENDING**

## Patent Warranty

We will defend any suit or proceeding brought against our customer so far as based on a claim that any apparatus, or any part thereof, furnished by us, constitutes an infringement of any patent of the United States, provided, that the customer causes us to be notified promptly in writing and given authority, information and assistance, (at our expense), for the defense of same, and we will pay all damages and costs awarded therein against such customer in any action of which said notice and authority and information were given to us. In case the apparatus or any part thereof is in such suit held to constitute infringement and it use is enjoined, we will, at our expense, either: procure for the customer the right to continue using said apparatus; or replace same with non-infringing apparatus; or modify it so it becomes non-infringing; or remove said apparatus and refund the purchase price thereof. The foregoing states our entire liability for patent infringement by said apparatus or any part thereof.

Mch 1933
Pat



MERCOID AUTOMATIC CONTROLS

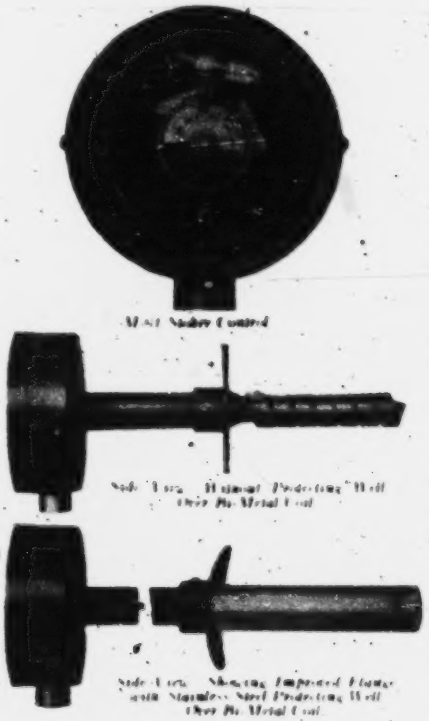
# MERCOID STOKER CONTROL TYPE M-61

**FOR INTERMITTENTLY FIRING COAL STOKERS—MAINTAINS LOW AND EVEN FIREBED**
**IMPROVED TYPE—WITH STAINLESS STEEL PROTECTING WELL OVER BI-METAL COIL**

The Type M-61 Mercoid stoker control has many outstanding features which improve the efficiency and general operation of a coal fired stoker.

This instrument is generally employed to fire the stoker intermittently during the period the room thermostat is in the "off" position, but may be used to limit the maximum temperature, or stop the stoker if the fire dies out.

Particular attention is called to the dial in the center of the instrument which is clearly and accurately calibrated from 50 to 650 F. A simple double adjustment is provided for individually setting both the "cut-in" and "cut-out" operating temperatures at any point within the instrument's range. This desirable feature permits quick setting to meet the variety of conditions encountered in stoker installations.



Another feature of decided importance is the temperature indicator located over the dial, which indicates in degrees Fahrenheit the temperature within the stack. Serving the same purpose as a thermometer, this temperature indicator assists at time of installation in determining the proper size of fire required and in correctly setting the controls.

## IMPROVED MOUNTING

We recommend the use of the improved type mounting flange and stainless steel well with sealed end for enclosing the bi-metal coil. This protects the sensitive bi-metal coil not only from deposits of fly ash, but also against corrosive action of the stack gases, so that frequent readjustments are not required to compensate for change in the operation of the bi-metal coil. This new feature can be supplied for instruments now in the field without this protection.

## ENCLOSED CONTACT

The Mercoid switch with its hermetically sealed mercury contact is immune to oxidation, dirt or corrosion. Burning, pitting and sticking,—sources of service trouble and expense with open-to-air contacts,—cannot occur with the sealed Mercoid switch. The contact remains permanently clean and the free flowing mercury insures perfect electrical contact at every operation.

## CONSTRUCTION

The 4½" steel case has a black heat resisting finish. The semi-glass cover is removable by loosening two screws. The wiring is simplified by means of ½" BX connection at bottom, and terminal posts within the case. A bakelite shield over the terminal posts prevents possibilities of shock while changing the control temperature setting.

*See Other Side For Specifications and Prices*

PA
FEB 1933
Mpls. Honeywell
MINNEAPOLIS, MINN.



M.M. March 1933

# MERCOID STOKER CONTROL TYPE M-61 (Continued)

## OPERATION

The high temperature bi-metal coil which is the operating element of this instrument is carefully heat treated to insure uniform and reliable operation. As the stack temperature increases or decreases this element revolves a stainless steel shaft which rotates the inner mechanism thus operating the Mercoid switch and at the same time indicating the stack temperature on the graduated dial. A relief spring is provided which permits the bi-metal coil to continue its natural course after the switch has been thrown to the "on" or "off" position, without straining this element.

When the room thermostat is in the "off" position the stoker fire gradually dies down, and may go out unless it is intermittently fired for short periods. As the fire dies down the stack temperature slowly decreases. When the type M-61 control is mounted in the stack, set for a low operating temperature, approximately 115° to 130° F., and connected in parallel with the thermostat circuit, it operates the stoker intermittently for short periods while the thermostat is in the "off" position. This not only prevents the fire going out, but also maintains a low and even fire bed. (See wiring diagrams.)

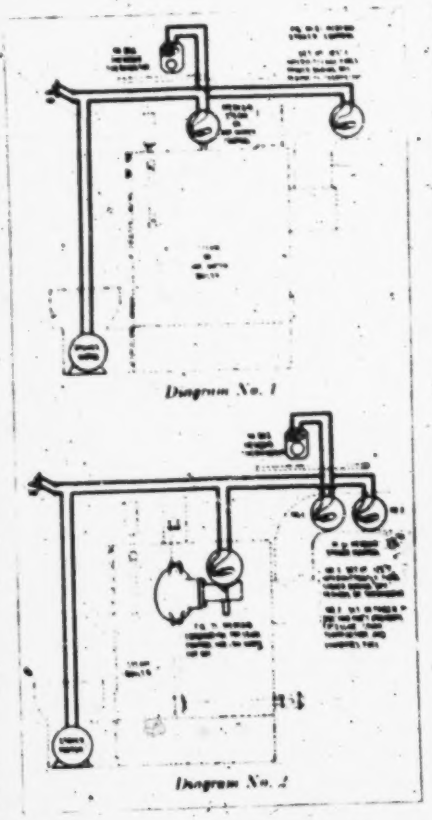


*Diagram No. 1*

*Diagram No. 2*

When the Fig. M-61 Mercoid Stoker Control is connected in series with the thermostat circuit, and set for a high operating temperature (from 300° to 450° F., depending upon boiler capacity and load on system) the efficiency of the stoker is increased and fuel saved.

When the stoker is firing continuously due to the thermostat calling for heat, the combustion gases continue to increase in temperature. After a certain temperature is reached, the boiler is operating at its maximum capacity and further firing only increases the stack temperature with a resultant waste of fuel. The Mercoid control stops the stoker from the increase in stack temperature, and the boiler continues to absorb the heat from the glowing fire bed. When the stack temperature lowers sufficiently the Mercoid control again starts the stoker. This operation is repeated until the thermostat cuts off.

The Type M-63 Mercoid Stoker Control is the same as Type M-61 except that it breaks the circuit on a dropping temperature. Set to stop the stoker by opening the circuit when the temperature drops to a low point (approximately 100° F.) it prevents filling the boiler with fresh coal when the fire is out. A snap switch connected around this control permits operation of the stoker while the fire is being started.

## ELECTRICAL SPECIFICATIONS

Mercoid stoker controls are furnished standard with a normal rating of 10 amperes at 110 volts, 5 amperes at 220 volts either A.C. or D.C. They directly handle without the use of a relay, motors within the following capacities:

| | |
|---|---|
| Repulsion-Induction | 1 H.P. |
| Direct Current | ½ H.P. |
| Split Phase | ½ H.P. |

Mercoid controls automatically regulate motors of the largest size when used as a pilot switch in connection with the proper motor starting switch. For this service they can be furnished with a normal rating of 4 amperes at 110 volts, 2 amperes at 220 volts, either A.C. or D.C., at reduced list prices.

## ORDERING DATA

When ordering specify type number of instrument, electrical capacity, and type of mounting flange desired. Unless otherwise specified, instruments are furnished single pole, 10 ampere, with improved type mounting flange and stainless steel well.

## LIST PRICES

| Mercoid Stoker Control | Single Pole Single Throw | |
|---|---|---|
| | 10 Amp. | 4 Amp |
| Type M-61, 50° to 650°, plain flange (without well) | $16.00 | $14.50 |
| Type M-61, 50° to 650°, improved flange with stainless steel well | 20.00 | 18.50 |

SHIPPING WEIGHT, APPROXIMATELY 4 lbs., 8 oz.



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**Plaintiff's Exhibit 14**

Coal-Gas Nov. 1933

# NOTE THE MANY FEATURES OF THE

# MERCOID

## M-61 STOKER CONTROL

## FOR INTERMITTENT FIRING OF COAL STOKERS TO MAINTAIN A LOW AND EVEN FIRE-BED

*Type M-61*

The dial in center is calibrated from 50 to 650 degrees F. Has simple double adjustment for setting both the cut-in and cut-out operating temperatures to meet any condition encountered in the stoker field.

Has temperature indicator which indicates the temperature within the stack to determine the right size of fire and facilitating correct control adjustments.

The sealed mercury contact switch is immune to oxidation, dirt, pitting or corrosion, therefore insures perfect electrical contact at every operation.

Available with an improved mounting flange and stainless steel well with sealed end to protect the sensitive bi-metal coil from fly ash and corrosive gases.

FURTHER INFORMATION CONTAINED IN BULLETIN No. 240.

*If you do not have the complete Mercoid Stoker Control Catalog write for it at once*

**THE MERCOID CORPORATION**

*Sole Manufacturers of The Mercoid Switch*

4211 Belmont Avenue Chicago, Illinois

# INSTALLATION INSTRUCTIONS

## MERCOID STOKER CONTROLS

### TYPES M-61, M-62, M-63

Patents Issued 13,531, 1,378,1[illegible] 1,640,869, 1,705,989, 1,752,957, 1,757,436, Others Pending

### IMPORTANT—NOTE

After removing all packing material, note tag warning not to twist the bi-metallic element. To do so may distort the metal and disarrange the adjustment which is correctly made at the factory. The Mercoid switch is wired in place to protect it during shipment. This wire must be removed after instrument is installed.

### MOUNTING

Carefully determine the location of the instrument. It is usually placed about two feet from the furnace, on the most convenient side of the stack. The correct location, however, depends upon the operating characteristics of the boiler. If the stack temperatures are high this instrument must be located at a greater distance from the boiler. A location should be decided on where the maximum stack temperature will not exceed 650° F., and where the instrument will not be covered with fly ash. If located close to the furnace, the temperature changes occur quickly and the resulting frequent operations are objectionable. If this control is located between the check draft and chimney, the check must not be operated, as the cold air admitted quickly cools the instrument and causes unnecessary operations.

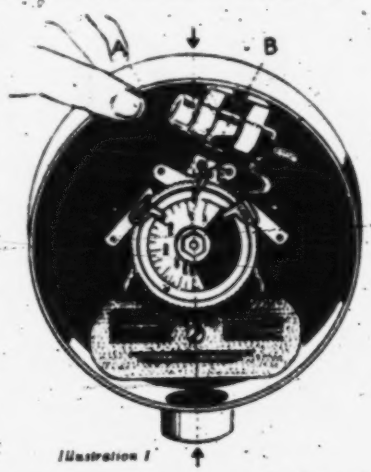

Illustration 1

Cut a 1⅛" hole directly on the side of the stack so that the stem of the instrument will be horizontal when mounted. Insert the stainless steel well and attach flange to stack by means of four screws provided. Insert the instrument bi-metal coil into stainless steel protecting well as far as it will go, then back out ½" and securely fasten instrument into flange by tightening set screw.

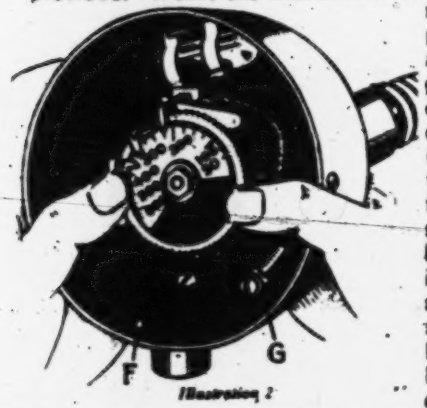

Illustration 2

Before tightening set screw, see that the instrument is level and also lined up vertically. This may be determined by separating the "high" and "low" adjustable pointers, "C" and "D", (illustration 1), until they hold the switch kicking plates away from the switch tripping arm "E." The switch must move freely from left to right without interference of the kicking plates. If the switch remains at either the right or left after tilting with the finger, the instrument is ready to be fastened by tightening lock nut on flange.

### ADJUSTMENT

The instrument can now be adjusted to the desired operating point. When setting the cut-in and cut-out points, hold the ratchet wheel firmly with one hand while pressing and moving either the high or low pointer; see illustration 2. When pressing pointers see that the catch between the teeth of the ratchet wheel is disengaged, as shown in "I," illustration 3.

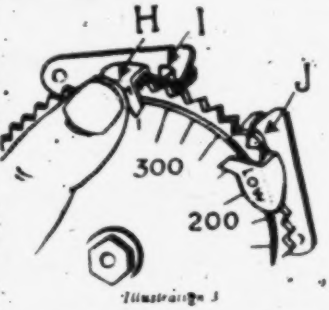

Illustration 3

### CAUTIONS

At no time should the instrument be subjected to more than 800 degrees Fahrenheit. If subjected to higher temperatures the calibration of the instrument will change and cause unsatisfactory operation. The instrument leaves the factory with the bi-metallic element properly formed, heat-treated, stabilized and calibrated. Should the temperature reading be in error due to an accidentally twisted bi-metallic element, if not excessively twisted it may be readjusted by allowing the instrument to reach room temperature, loosening the nut in the center of the dial and moving dial until correct reading is obtained, after which the nut should be tightened. Any manual twisting or bending of the element may permanently distort it. Not only will this destroy the correct calibration of the instrument but also the accurate performance after adjustment is made. In case the bi-metallic element is badly distorted a new element should be ordered for replacement. In ordering element the serial number of the instrument should be supplied.

DO NOT OIL ANY BEARINGS.

### WIRING

Illustration 4

Remove insulating plate indicated as "F" in illustration 2, by removing screw located in center of plate. Scrape and clean the wires and carefully place around the terminal screws, and in the groove provided (see illustration 4). After wiring, fasten insulating plate back in position. Be sure the connected load is not in excess of the controls rating as shown on the name plate. Fuses installed in the line should not exceed 10 amperes at 110 volts or 5 amperes at 220 volts.


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476 **Plaintiff's Exhibit 16**

# HEREIN LIES THE SOLUTION OF YOUR STOKER CONTROL PROBLEMS

## MERCOID STOKATHERM

TYPE JMV

This control introduces a new and greatly improved system of complete stoker regulation. It is a departure from present day methods of depending entirely on the operation of the stoker at definite timed intervals, or at fixed stack temperatures. • The firing periods of the STOKATHERM are directly responsive to the combustion condition and are automatically regulated to meet the variable conditions encountered on each installation. This procedure is a more direct approach to correct stoker performance, with the result that overheating is greatly curtailed. • The STOKATHERM operates the stoker for only the shortest periods necessary to maintain a minimum fire while the thermostat is in the "off" position. Consequently, there is also a saving in fuel consumption. • The out-fire feature of this control is important, because it guards against the possibility of filling combustion chamber with unburned fuel after fire has gone out or operating an empty stoker.

Note. With the advent of the bin-feed stoker, this out-fire control feature becomes doubly important

Write for bulletin No. 948-X

880 PLAINTIFF'S EXHIBIT 17.

(Letterhead of The Mercoid Corporation, Chicago.)

August 7, 1936.

To Solve the Stoker Control Problem.

Controlling the stoker during the fire maintaining periods has been a vexing problem which for years has kept the best minds in the industry working feverishly for a solution.

The enclosed extremely interesting report of the Anthracite Institute Laboratory on the Mercoid Type JMV Stokatherm is submitted for your information. We call to your attention that this same control is now available for bituminous as well as anthracite stokers.

It is our suggestion that you carefully read the enclosed Stokatherm bulletin. It will mean dollars and cents savings and freedom from service, permitting the dealer to devote his time to making new sales instead of servicing existing installations.

The Type JMV Stokatherm is the one stoker control that is an intelligent answer to the outfire problem.

Where the outfire feature is not a problem the Mercoid Stok-A-Timer may be employed. This control has special features not found in the conventional type of stoker timer. Detailed information on the Stok-A-Timer is going to the printer and will be ready for distribution shortly.

Both the Type JMV Stokatherm and the Mercoid Stok-A-Timer are equipped with the proven Mercoid Repulsion Type Relay, which provides its own low voltage to the thermostat circuit. No external transformer connections are required.

For an ideal control arrangement equip your stoker with Mercoid mercury contact controls throughout. The Mercoid Sensatherm provides sensitive regulation of room temperature while Mercoid Boiler Limit Controls insure dependabilty over long periods of time.

The Mercoid Corporation
J. W. Owens,
*Vice President.*

JWO:V

881 PLAINTIFF'S EXHIBIT 18.

No. 2192

Anthracite Institute Laboratory.

Mercoid Stokaherm: Type JMV.

Mfr.: Mercoid Corporation, 4201 Belmont Ave., Chicago, Ill.

Description: All automatic stokers of the on and off type should be equipped with some device for maintaining a fire when the thermostat is not calling for heat. If such controls are not provided, it is obvious that in the spring and fall and at other periods when heat is not required over prolonged intervals, the fire will become extinguished through lack of fuel.

It has been customary to use either a simple time switch operating for a certain number of minutes in each hour, or a temperature switch in the stack to perform the above operation. The Mercoid Stokatherm is a unit employing a combination of time and temperature to control the fire. In addition it includes a feature designed to automatically stop the stoker in case the fire is accidentally extinguished.

Result of Tests: Tests in the Anthracite Institute Laboratory indicated that the Stokatherm was very satisfactory. It was shown to be capable of maintaining a fire by operating a standard stoker between 1% and 1½% of the time. This is sufficiently low to represent economy and to prevent heat from reaching the living quarters. The ordinary time switch can be set for a lower interval but the Stokatherm possesses the additional advantage of automatically adapting itself to draft conditions and types of fuel, thus it should require less field adjustment and resetting than either the simple time switch or straight stack temperature controls. The out-fire control also prevents waste and inconvenience in case the fire is extinguished.

Data and Specifications.

Control Functions:—Transformer, Relay, Hold-Fire Control, Out-Fire Control.

Type of Switches:—Mercury Tube.

Thermostat Capacity:—24 Volts, 0.42 Amps.

Stoker Capacity:—1 H. P. Repulsion Induction, ½ H. P. Split Phase.

Electrical Capacity:—10 Amp., 110 Volts—5 Amps., 220 Volts, 60, 50, or 25 Cycle.

Dimensions:

Mechanism Case—4 x 5 x 6½ inches.

Overall Length—14½ inches.

Distance Extended from stack—9 to 11½ inches.

List Price:—$28.00 (subject to discounts).

Plaintiff's Exhibit 19

19

★ MERCOID ★

# STOKATHERM

REGISTERED TRADE MARK

TYPE JMV

## AN OUTSTANDING STOKER CONTROL

INCORPORATING THE FOLLOWING IMPORTANT FEATURES

RE MAINTAINING

FUEL SAVING

LIMITS OVERHEATING

OUT-FIRE OPERATION

RUGGED CONSTRUCTION EASY TO INSTALL LOWER SERVICE EXPENSE TO THE DEALER INCREASED ECONOMY TO THE USER

THE MERCOID CORPORATION · 4201 BELMONT AVENUE · CHICAGO, ILLINOIS

## INSTALLATION INSTRUCTIONS

**INSTALLING TYPE JMV STOKATHERM**—Choose the location with care. The usual location is about two feet from the furnace, on the most convenient side of the stack.

Cut a 1⅝" hole directly on the side of the stack so that the instrument stem is horizontal when mounted. Fasten the flange around the hole and insert the stem so that two rings "M" (see illustration No. 2) on the extension sleeve are visible.

BE SURE THE INSTRUMENT IS LEVEL, before tightening the flange set screw.

**WIRING**—Check nameplate on Stokatherm and see that cycle and voltage correspond with the current used. Be sure the connected load is within the motor rating of the control. Wire in accordance with diagrams in the cover, or if special hook-ups are desired, then in accordance with diagrams shown on back page.

Do not attempt to make any external transformer connections in the Sensatherm circuit as the Mercoid Transformer Relay induces its own low voltage.

RIGID CONDUIT MUST NOT BE ATTACHED DIRECTLY TO STOKATHERM OR BOILER LIMIT CONTROLS. Use a short strip (6 or 8 in.) of BX cable between control and conduit. If rigid conduit connections are made, expansion and contraction strains are very apt to break control connection at boiler.

Careless terminal connections are often responsible for service trouble. Scrape and clean wire and carefully place around terminal screw in the direction the screw turns. (See illustration No. 6.)

Illustration No. 6

Use two-wire armored low voltage cable between the Mercoid Sensatherm and the thermostat terminals of the relay. Bring the low voltage cable through the brass bushing "K" (see illustration No. 4) and securely attach wires to the terminals marked "Thermostat". Pull out excess cable and firmly clamp cable in bushing "K" by means of screw provided.

## ADJUSTMENTS

This control is provided with adjustments to vary the interval between fire maintaining operations and also the time of operation.

**INTERVAL ADJUSTMENT**—This adjustment sets the period between fire-maintaining operations. Lever "F" is adjustable over a dial calibrated from 10 to 70 minutes in 5 minute intervals.

**FIRE MAINTAINING PERIOD ADJUSTMENT**—While the Stokatherm changes its fire maintaining period automatically to meet varying fire conditions, adjustments are provided, however, to change the periods of operation needed to maintain a minimum fire on various types of heating plants.

The mounting flange is provided with a metal sleeve within which the position of the bimetal coil may be adjusted (see illustration 2). This is the primary adjustment for the fire maintaining period. If the bimetal coil is placed completely within the metal sleeve "H" the fire-maintaining period will be maximum. If completely exposed the period will be minimum. For convenience three rings "M" are cut on the mounting stem to indicate the position of the bimetal coil within the metal sleeve.

A secondary adjustment "R" is provided for increasing or decreasing the fire maintaining period beyond the limits of the primary adjustment "M". This adjustment is set at the factory and should not be changed except to meet abnormal field conditions. Moving to the right increases the fuel feeding period during the fire maintaining operation.

An additional adjustment "L" is provided to meet fluctuating stack temperature conditions. Moving this adjustment to the left prevents shut-down which might occur on installations where fluctuation of stack temperature occurs during normal thermostat operation. This adjustment is set at the factory and usually does not have to be changed.

## CONSTRUCTION DETAILS OF TYPE JMV STOKATHERM

The Type JM-V Stokatherm is a compact stack-mounted unit, combining a Timer Mechanism, the Mercoid Transformer Relay, and a Temperature-Actuated Mechanism. This instrument has been designed to provide fully automatic regulation of coal stokers. The important features of the various parts of this control are as follows:

**MERCOID TRANSFORMER-RELAY**—The Mercoid Transformer-Relay incorporated in this control is a very simple and compact device, which is in principle a low voltage transformer but also operates as a repulsion-relay.

Two independent insulated coils are mounted on a laminated iron yoke. The primary coil is fixed in position and is connected across the high voltage line. The secondary coil is movable and is connected to the low-voltage thermostat circuit. These two coils act as a transformer and low voltage is induced in the secondary coil when the primary coil is energized. When the low voltage thermostat circuit is closed, the secondary coil instantly moves upward, due to the repulsion action of the coils, and starts the stoker by closing the motor switch circuit "A".

As this transformer relay does not employ the conventional clapper type iron armature, rattling noises due to uneven, dirty or rusty armature faces, cannot occur. Furthermore, there can be no residual magnetism to affect the operation, as there are no metal contacting surfaces.

**TIMER**—The timer is actuated by a positive self-starting Waltham synchronous motor movement of the highest quality, with heavy cut brass wheels having pinions of hardened and polished tool steel.

**TEMPERATURE ACTUATED MECHANISM**—The temperature actuated mechanism responds to changes in stack temperature and, by means of a mechanical interlock, controls the starting of the timer interval period. After this period has elapsed, the stoker starts operating to maintain the fire and the length of operation is governed also by the temperature actuated mechanism.

The temperature actuated mechanism "J" of the Type JMV Stokatherm is radically different from conventional stoker stack controls. It does not operate at predetermined high and low temperature settings, but operates only on a differential or change in temperature. Operating by means of a unique ratchet assembly on a differential in temperature, this instrument differs from conventional stoker stack controls, in that it continually readjusts itself, regardless of changes or "sets" in the bimetal coil, due to excessive temperatures or corrosive flue gases.

**MERCOID MERCURY SWITCHES**—Mercoid mercury contact switches are used thruout. These switches, with their hermetically sealed mercury contacts, are immune to oxidation, dirt or corrosion. Burning, pitting and sticking—sources of service trouble and expense with open-to-air contacts—cannot occur with the sealed Mercoid switch. The contact remains permanently clean and the free flowing mercury insures perfect electrical contact at every operation.

## OPERATION OF TYPE JMV STOKATHERM

In order to clarify the description of operation of the Mercoid Type JMV Stokatherm, we are assuming normal conditions as encountered with the average domestic stoker. Under such conditions, the normal setting of the time interval adjustment "F" is 45 minutes.

**SENSATHERM CALLING FOR HEAT**—At the time the Sensatherm calls for heat the Stokatherm mechanism may be at any point in its cycle of maintaining the fire. The Sensatherm, however, immediately takes command and operates the stoker. Relay coil "B" rises and in turn closes motor switch "A". As the fire builds up the stack temperature rises, and the temperature actuated mechanism disengages the timer and returns it to its normal starting position. No strain is placed on the bimetal coil as the temperature continues to rise, as free movement is permitted thru the ratchet mechanism.

**FIRE MAINTAINING**—When the Sensatherm opens its circuit due to the room's being at the required temperature, the Mercoid Relay "B" instantly opens its circuit and stops the stoker. The fire now starts dying down and the stack temperature decreases accordingly. As this decrease in stack temperature occurs, the temperature actuated mechanism "J" engages the interval timer and within the period as set by adjustment "F", which we have assumed at 45 minutes, switch "C" closes its circuit and operates the relay, which, in turn starts the stoker.

UNDER NO CIRCUMSTANCES, CAN THE STOKER OPERATE TO MAINTAIN THE FIRE, IN LESS THAN 45 MINUTES (ASSUMED SETTING) AFTER THE THERMOSTAT SHUTS OFF. DURING THIS 45 MINUTE DELAY PERIOD, THE STACK TEMPERATURE CONTINUES TO DECREASE. On the average installation considerable drop in stack temperature occurs during this first 45 minute delay period, and the temperature actuated mechanism accordingly follows this change. To maintain the fire the stoker operates only until a rise in stack temperature occurs. THE CONDITION OF THE STOKER FIRE IS ACCURATELY INDICATED BY THE RATE AT WHICH THE STACK TEMPERATURE RISES. The firing periods are not at definitely timed intervals or at fixed stack temperatures, but are automatically regulated by this control.

The stoker continues to operate intermittently for only the very shortest periods necessary to maintain the fire during the time the thermostat is in the off position. This not only results in a very decided saving in fuel, but also insures against overheating.

**OUT-FIRE OPERATION**—Should the fuel become exhausted, or the fire go out, the stack temperature lowers, causing the temperature actuated mechanism to engage the interval timer. Even though the thermostat is in the "on" position calling for heat, the Stokatherm mechanism operates, and after the out-fire period (factory setting 50 minutes) has elapsed, switch "G" opens its circuit and stops the stoker. When the fire has been rekindled the stoker may start due to the rise in stack temperature, or may be restarted by pressing hand reset button "D".

## OPERATING INSTRUCTIONS

On the average domestic heating plant, operating with a good grade of stoker coal, the following adjustments are usually found satisfactory:

1. Bimetal coil inserted half way within metal sleeve (2 rings "M" on sleeve exposed).
2. Interval adjustment "F" set at 45 minutes.
3. Secondary adjustments "R" and "L"—no change from factory setting.

IF THE FIRE HAS GONE OUT WITH FUEL IN THE HOPPER, causing out-fire shutdown at the control, this is due either to the interval adjustment "F" being set too long or to the fire-maintaining period being too short. This condition can be overcome either by decreasing the timer interval adjustment or by increasing the fire-maintaining period.

Extreme changes in these adjustments should not be made immediately. We recommend proceeding as follows:

1. Change time interval adjustment "F" from 45 minutes to 30 minutes. **Caution:** Do not decrease beyond this point unless all following instructions have been followed or overheating is apt to occur.
2. If outfire again occurs move bimetal coil ½" further within protecting sleeve "H" (2½ rings exposed).
3. If conditions of installation are such that sufficient fire-maintaining period is not now provided move bimetal coil entirely within metal sleeve "H" (3 rings exposed).
4. The above adjustments will take care of all except very abnormal operating conditions, in which case move adjustment "R" to the right.

**OVERHEATING DURING FIRE MAINTAINING PERIOD**—If overheating occurs this can be overcome either by increasing the time interval adjustment or by decreasing the fire-maintaining period. To accomplish this proceed as above except reverse all instructions.

IF CONTROL HAS SHUT DOWN ON OUT-FIRE, BUT FIRE HAS NOT GONE OUT, this is usually caused by a drop in stack temperature occurring during period the thermostat is operating the stoker. This condition does not occur with anthracite stokers but with bituminous stokers is generally due to one of the following reasons:

1. COKING COALS forming pyramids which allow free passage of air thru the fuel-bed.
2. IMPROPER CARE OF FUEL-BED resulting in an excessive amount of clinkers and an uneven fire-bed which allows free passage of air.
3. COALS THAT ARE HARD TO IGNITE—If green coal entering the combustion chamber does not ignite readily, the existing fire will be pushed to the side and cold air can then freely pass thru the green coal.

Adjustment "L" is provided to take care of fluctuations in stack temperature encountered on the average installation. If above conditions exist this adjustment should be pushed to the left. It must be remembered, however, that this control will not fully take care of extreme conditions such as above, and that some other means must be employed to overcome them.

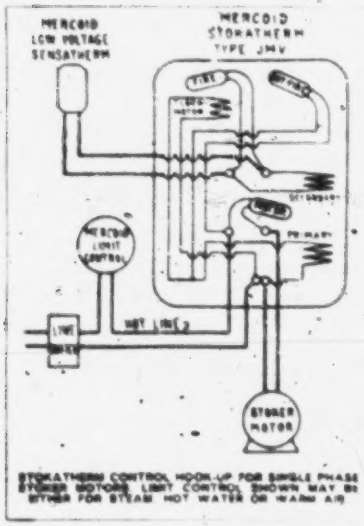
After the control has shut down on out-fire, should a good fire-bed be re-established and a rise in stack temperature occur, the control will automatically reset and resume operation of the stoker.

## NOTES FOR SERVICE MEN

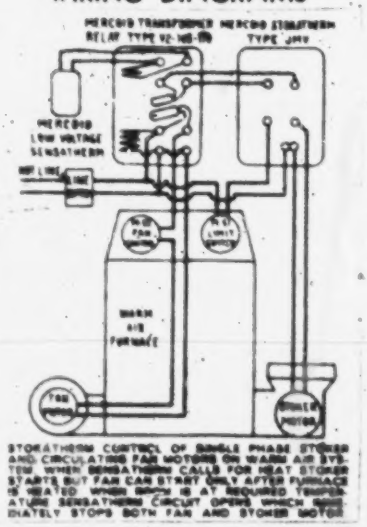
1. If the stoker has stopped due to fire's going out, rekindle fuel and start stoker by closing thermostat circuit and pushing reset button "D" (Illustration No. 4).
2. When kindling a fire an abnormally high stack temperature generally occurs, which drops off after a short period of operation. The large drop in stack temperature is apt to put the timing mechanism in operation, and after a period of time the control would assume an out-fire position. Before leaving the installation, stop the stoker by opening the main switch and, after a delay of not less than 5 minutes, push reset button "D" and then close the main switch. The control will now be in its normal running position.
3. Tube "C" is fire-maintaining switch. This switch is in parallel with the thermostat, and when it is in the "on" position the stoker operates. This switch is closed only by the timer motor.
4. Tube "G" is out-fire switch. When this switch is in the "off" position, the stoker cannot operate. This switch is set at the factory to open its circuit within 50 minutes. This adjustment cannot be changed.
5. Tube "A" is motor switch.
6. When the thermostat calls for heat it immediately takes command of the stoker operation.
7. When coal is used which leaves a heavy soot deposit in the stack, the bimetal coil should be cleaned at regular intervals.
8. Overheating may occur if secondary adjustment "R" is moved to extreme right.
9. Outfire may occur if secondary "L" is moved to extreme left.

**CAUTION**—HAVE YOU READ DESCRIPTION OF OPERATION AND INSTRUCTIONS CAERFULLY? KEEP INSTRUMENT COVERS CLOSED. DO NOT OIL ANY PARTS. DO NOT OVERLOAD—See electric rating on nameplate. DO NOT ATTEMPT TO DISCONNECT OR CHANGE ANY PARTS

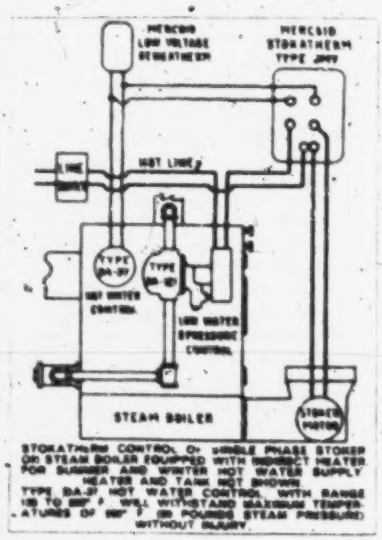
## WIRING DIAGRAMS




STORATHERM CONTROL HOOK-UP FOR SINGLE PHASE STOKER MOTORS. LIMIT CONTROL SHOWN MAY BE EITHER FOR STEAM, HOT WATER OR WARM AIR.




STORATHERM CONTROL OF SINGLE PHASE STOKER AND CIRCULATING FAN MOTORS ON WARM AIR SYSTEM. WHEN SENSATHERM CALLS FOR HEAT STOKER STARTS BUT FAN CAN START ONLY AFTER FURNACE IS HEATED. WHEN BONNET IS AT REQUIRED TEMPERATURE SENSATHERM CIRCUIT OPENS WHICH IMMEDIATELY STOPS BOTH FAN AND STOKER MOTOR.




STORATHERM CONTROL OF SINGLE PHASE STOKER ON STEAM BOILER EQUIPPED WITH IMMERSION HEATER FOR SUMMER AND WINTER HOT WATER SUPPLY. HEATER AND TANK NOT SHOWN. TYPE HA-2F HOT WATER CONTROL WITH RANGE ADJUSTABLE FROM 100 TO 180° F. WILL WITHSTAND MAXIMUM TEMPERATURES OF 300° F. OR POUNDS STEAM PRESSURE WITHOUT INJURY.

Plaintiff's Exhibit 20 485

# GENERAL APPLICATIONS AND WIRING DIAGRAMS

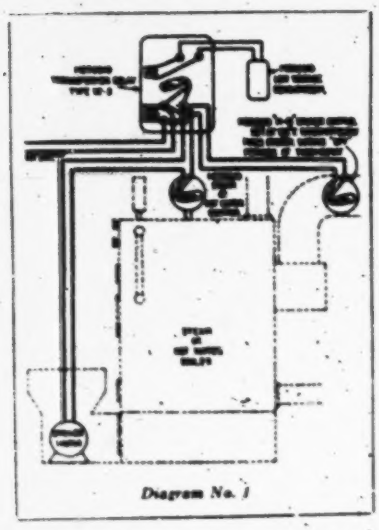


Diagram No. 1

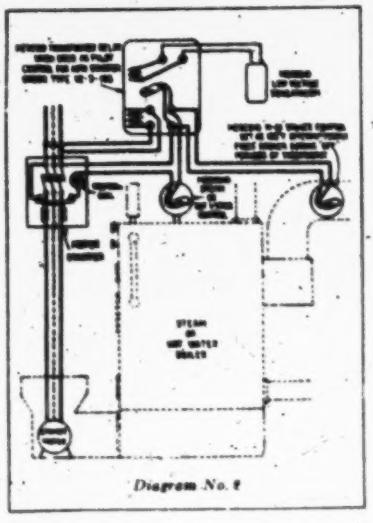


Diagram No. 2

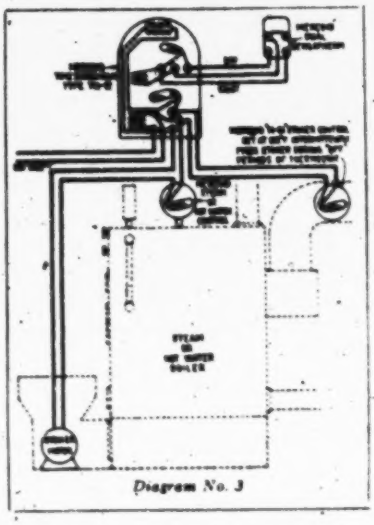


Diagram No. 3

DIAGRAM No. 1 shows the general hook-up in connection with domestic stokers where the motor load can be directly handled by the controls. When the Type M-61 stoker control is connected in parallel with the relay circuit, and set for a low operating temperature, approximately 115 to 130° F., it operates the stoker intermittently for short periods when the room is up to temperature and the Sensatherm has the relay in the "off" position. This not only prevents the fire from going out, but also maintains a low and even fire bed.

DIAGRAM No. 2 shows the hook-up when large stoker motors are employed which require the use of airtomatic motor starters. This same hook-up applies also when two or three phase motors of any size are employed. The motor starter affords protection against over-load or single phasing. Type M-61 stoker control functions the same as in diagram No. 1.

DIAGRAM No. 3 is identical to diagram No. 1 with the exception that a dual Sensatherm is employed with an electric Time Switch Relay and affords DAY and NIGHT temperature control. At a pre-determined hour in the evening the clock transfers the room temperature control from the day setting to the night setting of the Dual Sensatherm. A lower room temperature is then maintained until the pre-determined set time in the morning when the clock again transfers the control to the day setting of the Sensatherm. Type M-61 stoker control functions to maintain the fire regardless of whether the Dual Sensatherm is operating on its day or night setting

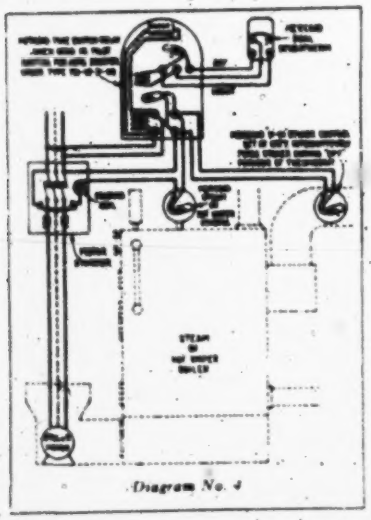


Diagram No. 4

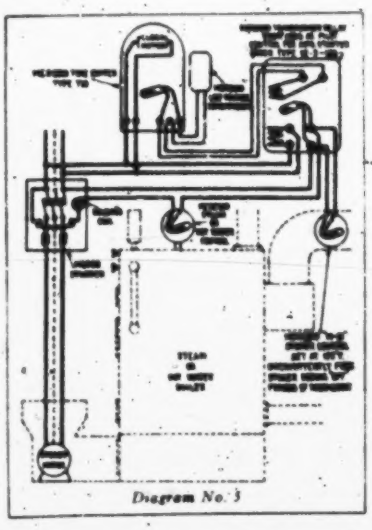


Diagram No. 5

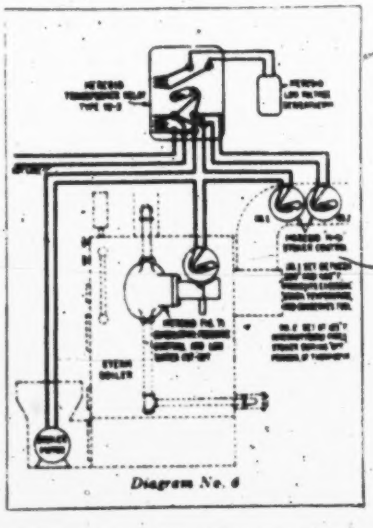


Diagram No. 6

DIAGRAM No. 4 shows the hook-up where DAY and NIGHT temperature control is desired in connection with stokers employing large motors or motors operating on two or three phase current. The controls operate in the same manner as explained under diagram No. 3, and the motor starter provides over-load and single phase protection.

DIAGRAM No. 5 shows the hook-up for large stoker installations where a thermostat controls the room temperature during the day, but at night when the fire is banked an electric time switch opens the thermostat circuit. The M-61 stoker control then prevents the fire going out until early morning when the time switch again places the thermostat in control. This circuit hook-up applies on jobs where controls were orginally installed as per diagram No. 2, and the time switch feature added at a later date. On new installations where this hook-up is desired the time switch and transformer-relay can be furnished in a combination unit (Type V2-3-116).

DIAGRAM No. 6 shows the application of Type M-61 stoker control on installations where high stack temperatures are encountered. Instrument No. 1 intermittently fires the stoker during the periods the room is up to temperature and the Sensatherm has the relay in the "off" position. Instrument No. 2 is connected in series with the relay, and when set for a high operating temperature (350 to 500° F., depending upon boiler capacity and load on system) increases the efficiency of the stoker and conserves fuel. When the stoker is firing continuously due to the Sensatherm calling for heat, the stack temperature continues to increase. After a certain temperature is reached, the boiler is operating at its maximum capacity and further firing only increases the stack temperature. The Mercoid control (No. 2) limits the stack temperature by stopping the stoker and thus conserves fuel. When the stack temperature lowers sufficiently the Mercoid control again starts the stoker, and this operation is repeated until the Sensatherm opens its circuit.

# Plaintiff's Exhibit 21

# MERCOID IMMERSION TYPE BOILER CONTROLS

Mercoid Immersion Type Controls have proven by their unfailing accuracy and durability, over years of service, to be the correct type of automatic limiting device for control of motor driven units on hot water boiler installations and vapor vacuum heating systems.

There is no lag in the operation of these controls such as is encountered with controls mounted on the outside of the boiler or risers. The brass bulb is installed directly in the boiler water and the volatile liquid charging quickly and accurately follows temperature changes.

These controls are equipped with a snap action movement insuring positive operation of the Mercoid switch when the water reaches the temperature for which the control is set.

Fig. 36

## APPLICATIONS

HOT WATER BOILERS—As a safety limiting device, Fig. 36 or 37 with range No. 2 is recommended.

HOT WATER STORAGE TANKS—As a regulating instrument, Fig. 36 or 37 is recommended with either range No. 1 or No. 2 depending on temperature desired.

INDIRECT WATER HEATERS ON STEAM BOILERS—To supply domestic hot water from a steam boiler the control must operate the burner during the no heat period when the thermostat is shut off, and to hold the boiler temperature just below the steaming point. Fig. 37 with range No. 2 mounted on side of steam boiler below water line gives excellent results. This instrument will withstand 250° F. (15 lbs. steam pressure) without injury.

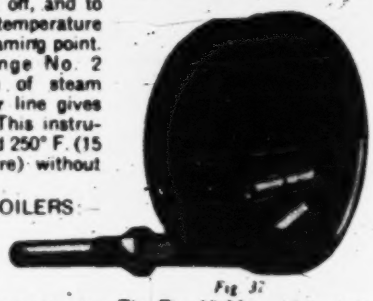


Fig. 37

VAPOR-VACUUM BOILERS—The temperature of the water in a boiler changes according to changes of pressure or vacuum. The Fig. 37 Mercoid control range No. 3 when installed on the side of a Vapor-Vacuum boiler below the water line, will give very positive regulation and overcome troubles due to loss of vacuum. When set low this control will cut out at 214° (10 oz. pressure) and will cut in at 200° (6" vacuum), but can be set to cut out as high as 226° (4½ lbs. pressure) and cut in at 214° (10 oz. pressure).

## LIST PRICES

| | |
|---|---|
| Fig. 36—Ranges No. 1 and 2, Single pole, 10 amp. | **$18.00** |
| Fig. 37—Ranges No. 1 and 2, Single pole, 10 amp. | **20.00** |
| Fig. 37—Range No. 3, Single pole, 10 amp. | **22.00** |

FIG. 36 AND 37—RANGE AND ADJUSTMENT DATA

| Range Number | Range Specification | Range Adjustment | OPERATION | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Low Setting | | Medium Setting | | High Setting | |
| | | | Cut-In Temp | Cut-Out Temp | Cut-In Temp | Cut-Out Temp | Cut-In Temp | Cut-Out Temp |
| No. 1 | 105° to 160° | 30 | 105 | 130 | 125 | 145 | 145 | 160 |
| No. 2 | 140° to 214° | 49 | 140 | 165 | 178 | 190 | 200 | 214 |
| No. 3 | 200° to 226° | 12 | 200 | 214 | 207 | 220 | 214 | 226 |

# MERCOID CONTROLS—FURNACE, STOKER, ETC.

## TYPE M-53 WARM AIR FAN CONTROL

Type M-53

This instrument has a simple double adjustment, for both "high" and "low" operating temperatures.

The temperature indicator located over the dial serves the same purpose as the thermometer on a hot water boiler.

The dial, located in the center of this instrument, is calibrated from 50° to 650° F.

Can be quickly mounted to any furnace hood as the new flange is adjustable between 30 and 90 degrees.

Electrical Rating—10 amp.-110 volt, 5 amp.-220 volt.

List prices, single pole **$16.00**

**DEALERS' SPECIAL NET PRICE**

| Chicago | F. O. B. New York | West Coast |
|---|---|---|
| **$6.50** | **$6.75** | **$7.00** |

## TYPE M-61 STOKER CONTROL

The Type M-61 Mercoid Stoker Control has many outstanding features. It is sturdily constructed and has the advantage of a simple double adjustment, for both "high" and "low" operating temperatures, to meet the variety of conditions encountered in stoker installations. Range adjustable from 50° to 650° F.

Type M-61

The temperature indicator located over the dial serves the same purpose as a thermometer, and will assist at the time installation is made in determining the proper size of fire required and in correctly setting the controls.

The efficiency and general operation of a stoker will be improved by the use of the Type M-61 Mercoid Stoker Control.

When this control is mounted in the stack, set for a low operating temperature, approximately 115° to 130° F. and connected in parallel with the thermostat circuit, it will operate the stoker intermittently for short periods at a time, when the thermostat is in the "off" position. This will not only prevent the fire from going out, but will also maintain a low and even fire bed.

Electrical Rating—10 amp.-110 volt, 5 amp.-220 volt.

List price, Single Phase $16.00

**DEALERS' SPECIAL NET PRICE**

| Chicago | F. O. B. New York | West Coast |
|---|---|---|
| **$6.50** | **$6.75** | **$7.00** |

## FIG. 46 MERCOID LEVER CONTROL

The Fig. 46 Mercoid Lever Control opens and closes the circuit by means of mechanical movement of the lever arm.

Recommended where close regulation is desired on vapor heating systems that are equipped with diaphragm pressure regulators.

Electrical Rating—10 amp.-110 volt, 5 amp.-220 volt.

Motor Rating—1 H.P. Rep.-Ind. ½ H.P. D.C. 1 H.P. Split Phase.

Ordering Data—Specify whether mounting flange required at top or bottom. Whether lever arm required at left or right side of case. Whether circuit is to close with lever in up or down position.

List price **$15.00**

Fig. 46

Controls shown in this bulletin are covered by patents Nos. 1,521,638; 1,598,674; 1,640,889; 1,644,930; 1,658,013; 1,687,642; 1,705,989; 1,734,015; 1,736,016; 1,752,957; 1,757,436; 1,817,634; 1,834,288; others pending. The right to use for domestic or industrial heating the oil burner system covered by Patent No. 1473139 is granted only when Mercoid pressure or low water controls are used in connection therewith.

**Plaintiff's Exhibit 22**

# BUILT TO ENDURE

## MERCOID CONTROLS

*Are recommended for all types of heating equipment*

Modern engineering skill has made automatic heat practically fool-proof and within the reach of every home. Avail yourself of this greatest of all modern conveniences.

Automatic heating equipment is no better than the controls that govern it. When you specify Mercoid Controls you may be assured that you will get the best that money can buy.

Mercoid Controls may be termed custom-built instruments. All Mercoid Controls are subjected to rigid tests and inspection for proper material, exact workmanship and positive operation. Each control has its individual serial number for identification. Mercoid Controls must be right, for they are built right.

The Mercoid Sensatherm illustrated herewith, is acclaimed the most sensitive thermostat upon the market. It maintains an even room temperature within one degree at all times without the aid of any internal heater coils or artificial stimulation.

The Sensatherm is neat, small and beautiful in appearance. It will grace the wall of any home. It harmonizes with any scheme of interior decoration.

Apart from appearance, it is performance that counts, and in this respect it is unexcelled. The Sensatherm is the modern thermostat for accurate and reliable room temperature control.

All switches in Mercoid Controls are of the sealed mercury contact type. They cannot be affected by dust, dirt or corrosive gases and will operate indefinitely without deterioration.

In order that you may be assured of getting the best results from your automatic heating equipment, insist upon—

## MERCOID CONTROLS

# USED THE WORLD OVER

890 PLAINTIFF'S EXHIBIT 23.

(Letterhead of The Mercoid Corporation, Chicago.)

January 22, 1934.

Mercoid Controls—Manufacturers' Schedule.

Revised price sheet (A-51) applying to Mercoid Controls is enclosed herewith—

Attention is directed to new lower price now in effect when Type H Sensatherm and Type V Relay are ordered in combination—

Also lower price effective on the No. 855 High Voltage Thermostat, as well as new intermediate schedule (10 to 24) which affords a reduction on all controls illustrated in catalog.

The acquisition of complete manufacturing rights on the Triplex Time Switch permits a price reduction on this item.

In addition to new low list Mercoid cut-off for pressures up to 30 lbs. there is a complete line of combination pressure and low water cut-off controls illustrated in Bulletin #210 of Mercoid catalog.

When requesting catalog, please advise type of equipment being manufactured.

An opportunity to be of service is solicited.

Yours very truly,
The Mercoid Corporation
J. W. Owens,
*Vice President.*

JWO:C

**Plaintiff's Exhibit 24**

# MANUFACTURERS PRICES 491

EFFECTIVE JANUARY 15, 1934 — SUBJECT TO CHANGE WITHOUT NOTICE

# MERCOID AUTOMATIC CONTROLS

FOR HEATING, REFRIGERATION, AIR CONDITIONING AND INDUSTRIAL APPLICATIONS

## GENERAL DISCOUNTS

Shipments of 1 to 9 . . . . . 50-5%
Shipments of 10 to 24 . . . . . 50-10-5%
Shipments of 25 or more . . . . . 50-20-5%

The above discounts apply to the List Prices of all Mercoid Controls with the exception of those listed below

## SPECIAL NET PRICE MERCOID CONTROLS

ELECTRICAL RATING: 10 AMP.-110 V., 5 AMP.-220 V. Motor Rating: 1 H.P. Repulsion Induction, ½ H.P. Split Phase or D.C.

| Type No. | DESCRIPTION | Bulletin No. | List Price | MANUFACTURERS' NET PRICES Single Shipment Quantities | | |
|---|---|---|---|---|---|---|
| | | | | 1 to 9 | 10 to 24 | 25 or more |
| | **THERMOSTATS** | | | | | |
| H V | Low Voltage Combination Sensatherm and Relay:—Sensatherm, 55-85°, Gold Finish with Thermometer | 100 | $10.00 | | | |
| | Transformer Relay, 24 volt Thermostat Circuit Capacity, Single Pole, 10 Amp.-110 V. 60 Cyc. or 5 Amp.-220 V. 60 Cyc. | 110 | 15.00 | | | |
| 855 | Type H and Type V Combination, SET PRICE | | | $10.00 | $ 9.25 | $8.55 |
| | High Voltage Thermostat, with Thermometer, Single Pole-10 Amp., available Standard Ranges, 56-80°, 38-60°, 45-72° | 120 | 24.00 | 11.00 | 10.00 | 9.00 |
| | **PRESSURE** | | | | | |
| Fig. 31 | Range No. 1 (Standard) 1 to 10 lbs., Diff. 3 lbs. | 200 | 16.00 | 6.00 | 5.50 | 5.00 |
| Fig. 31 | Range No. 2, 0 to 3 lbs., Diff. 2 lbs. | 200 | 16.00 | 6.00 | 5.50 | 5.00 |
| Fig. 31 | Range No. 3, ½ to 4½ lbs., Diff. 2½ lbs. | 200 | 16.00 | 6.00 | 5.50 | 5.00 |
| | **HOT WATER** | | | | | |
| Fig. 35 | Risertherm (Clamp-on Type), 110 to 200° | 220 | 16.00 | 6.00 | 5.50 | 5.00 |
| | **WARM AIR** | | | | | |
| M-51 | Furnace Limit Control, 50-650° | 230 | 16.00 | 6.00 | 5.50 | 5.00 |
| M-53 | Furnace Fan Control, 50-650° | 230 | 16.00 | 6.00 | 5.50 | 5.00 |
| | **STOKER** | | | | | |
| M-61 | Stoker Control, 50-650°, Plain Flange (without well) | 240 | 16.00 | 6.00 | 5.75 | 5.50 |
| M-61 | Stoker Control, 50-650°, Improved Flange with Stainless Steel Well | 240 | 20.00 | 7.60 | 7.30 | 7.00 |

ASSORTMENT:
An order for assorted controls may include list and discount as well as net price items. Each group in the assortment is billed at the price applying to the total quantity ordered.

## SOLENOID VALVES

NUMBER 682 AND 683

(Solenoid Valves may not be included in calculation of the total of an order for an assortment as above defined.)

Shipments of 1 to 9 . . . . . 50% Shipments of 10 to 24 . . . . . 50-5%
Shipments of 25 or more 50-10%

## SPECIAL COMPLETE SET NET PRICES

Manufacturers of equipment requiring Thermostats, Boiler Controls and Combustion Controls are requested to write for Special Net Set Prices. When making application advise approximate yearly requirements and number of sets desired in single shipments.

## TERMS

2% for cash within 10 days from date of invoice, or net 30 days, subject to approval of credit rating. All prices F.O.B. Factory.

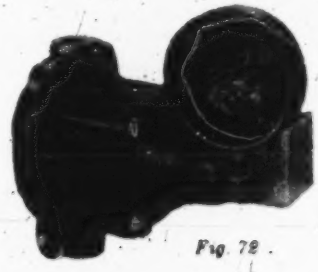


Fig. 72

NEW LOW RANGE Fig. 72

## MERCOID LOW WATER CUT-OFF

FOR PRESSURES UP TO 30 LBS.
PROTECT YOUR BOILER AT THE WATER LEVEL

Construction identical to Standard Fig. 72 shown in Bulletin No. 210 except equipped with float for 30-pound maximum pressure.

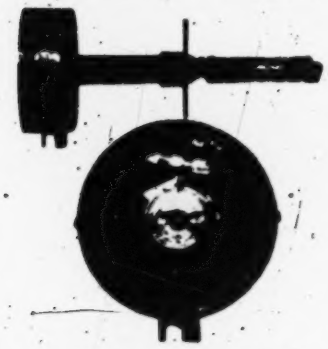
**List Price . . . . . $30.00**
LESS GENERAL DISCOUNTS

THE MERCOID CORPORATION — 4201 Belmont Ave., Chicago, Ill.

Form No. A-51

**Mercoid Corporation Has New Double Adjustment Control**

The Mercoid Corporation announces a new double adjustment control, employing the new type of tipless Mercoid switch independently mounted and actuated by a thermostatic metal coil. This control is used as a limiting device in connection with automatic heating equip-



The Double Adjustment Control

ment to prevent over-heating of warm air furnaces, as well as a booster fan control to start the furnace fan motor when the furnace hood temperature has reached a predetermined degree and stop the fan motor on a predetermined drop in temperature.

A unique feature in this control is a pointer which indicates the temperature in the furnace duct so that one may see at a glance what heat the furnace is generating. This information is useful in determining the amount of heat required for any desired condition. A quick change adjustment is provided for both high and low points, so that any required differential and temperature within its range may be secured. The control has a glass front, bringing the dial readings clearly in view.

No relay or starting switch is needed where the normal working load does not exceed 10 amperes at 110 volts or 5 amperes at 220 volts, A. C. or D. C.

The instrument is convenient in size, having a case dimension measuring 4¼ inches in diameter. This control may be operated at temperatures up to 650 degrees F. Adjustment directions are conveniently indicated on the control. For full information write to the Mercoid Corporation, 564 West Adams Street, Chicago.

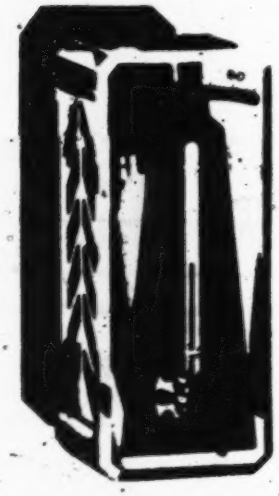
"AMERICAN ARTISAN"
"JULY 19,1932"

## Plaintiff's Exhibit 25

**Controls Air Temperature**

THIS thermostat is a low-voltage air-temperature control designed to operate in connection with a transformer relay; on alternating current the voltage is under [illegible] volts and when used in connection with a repulsion relay, the same instrument can be used on d-c. It was designed with particular attention paid to sensitivity, compactness and neatness.

It is operated by means of a spiral bimetallic element sensitive to changes in temperature. One end of the element is attached to the range adjustment lever and the other end is free and moves a small permanent magnet attached to it. When the temperature of the bimetallic element goes below the temperature for which the device is set, the magnet is held in close proximity to the switch, which contains a fixed set of contacts and a movable armature pivoted at its upper end and having a cup containing mercury at its lower end, all hermetically sealed in glass. The movable armature in the switch is drawn toward the magnet and the mercury cup is in such position so that the mercury closes the circuit between the fixed contacts. As the temperature increases, the bi-metallic coil moves the magnet away from the switch.



When the pull of the magnet can no longer hold the armature, the mercury cup moves away from the contacts and the circuit is opened. At the same time the armature swings back, the pull on the magnet is released and it goes back into position where it no longer affects the armature. Contact is closed and opened with a positive snap action.

Standard range is from 55 to 85 F and it operates on a temperature variation of ¼ deg. above or below the point set; this total differential of 1 deg. can be increased to 2 deg. by an adjustment. The instrument is made by The Mercoid Corporation, 4201 Belmont Ave., Chicago.

"HEATING PIP & AIR COND"
"JULY 1932"

# Plaintiff's Exhibit 26

## Mercoid Furnace Controls

In the accompanying illustrations are shown two of the Mercoid controls designed for use in connection with warm-air furnace heating. The thermostat shown in full front view and with the cover removed, is designed

Mercoid Thermostat Front View Cover in Place

Mercoid Thermostat Front View Cover Removed

for control of air temperature from within the rooms. The other is an instrument operating from the hood or piping to prevent the overheating of warm-air furnaces, controlling either dampers or the operation of a fan in a furnace heating system.

Mercoid Furnace Control Switch

These instruments employ a combination of a mercury switch and metal bellows; which operate a motor that in turn operates the dampers or switches on and off the current to the fan motor.

The thermostat is naturally placed in the room in which it is desired to control the air temperatures, and operates a motor to close and open the draft dampers of the furnace. The hermetically sealed mercury tube and the metal bellows are shown in the view with the cover removed.

The second illustration shows a front view of a control which is connected to a tube inserted in a furnace bonnet or duct. The tube is charged with an expansive liquid, which on expanding operates the device. This, in turn, actuates the switch of the motor which operates the fan; or the dampers, through a motor mechanism.

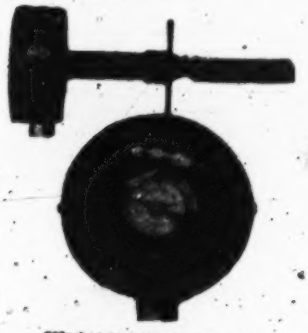
Thus it will be seen that the foregoing instruments constitute a dual control for a furnace heating system.

"SHEET METAL WORKER"
"NOVEMBER 1929"

***Furnace Control.***

THE Mercoid Corp. announces a new Double Adjustment Furnace Control employing the new tipless Mercoid switch independently mounted and actuated by a thermostatic metal coil. This control is a limiting device for automatic gas or oil heating equipment to prevent overheating warm air furnaces, also a booster fan control to start and stop the furnace fan motor at a predetermined rise or fall in temperature in the furnace hood.

A unique feature of this control is an indicating pointer showing the temperature in the furnace duct so that the heat the furnace is generating at any time may be read at a glance and permitting of variations to meet any desired conditions. A simple, quick change adjustment is provided for both high and low limits so that any required difference of temperature within its range may be secured. The control, [illegible] front, bringing the dual [illegible] clearly in view. No relay or starting switch is needed where the normal working load does not exceed 30 amperes at 110 volts or 5 amperes at 220 volts, A. C. or D. C.



Mercoid Double Adjustment Furnace Control

The instrument is [illegible] having a case dimension measuring 4½ in. in diameter. This control may be operated at temperatures up to 450 deg.

"SANITARY HTG.AGE"
"AUGUST 1929"

### "Mercoid" New Name of Merged Companies

The Federal Gauge Company and the Arcleo Contact Company, the merging of which was recently announced in FUEL OIL, are now operating under the name "The Mercoid Corporation." The offices of the new corporation will remain the same as those of the old Federal Gauge Company, and both factories will remain in operation.

"FUEL OIL JOURNAL"
"APRIL 1928"

"MERCOID Controls for Heating Equipment" are described on an attractive 32-page illustrated catalog featuring the various types of mercoid control switches and thermostats, including typical wiring diagrams.

"WARM AIR HEATING"
"DEC 1929"

Plaintiff's Exhibit 29

# TYPE M-61 STOKER CONTROL

The Type M-61 Mercoid Stoker Control has many outstanding features. It is sturdily constructed and has the advantage of a simple double adjustment for both "high" and "low" operating temperatures to meet the various conditions encountered in stoker installations. Range adjustable from 50 to 450° F.

The temperature indicator located over the dial serves the same purpose as a thermometer and will assist at the time installation is made in determining the proper size of fire required and in correctly setting the controls.

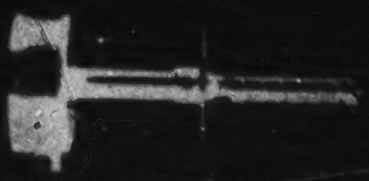
The efficiency and general operation of a stoker will be improved by the use of the Type M-61 Mercoid Stoker Control.

When this control is mounted in the stack, set for a low operating temperature, approximately 115 to 130° F. and connected in parallel with the thermostat circuit, it will operate the stoker intermittently for short periods at a time when the thermostat is in the "off" position. This will not only prevent the fire from going out, but will also maintain a low and even fire bed. See wiring diagrams.

When the Fig. M-61 Mercoid Stoker Control is connected in series with the thermostat circuit and set for a high operating temperature (from 300 to 450° F. depending upon boiler capacity and load on system) the efficiency of the stoker will be increased and fuel will be saved.

When the stoker is firing continuously due to the thermostat calling for heat, the combustion gases will continue to increase in temperature. After a certain temperature is reached, the boiler will be operating at its maximum capacity and further firing would only increase the stack temperature with a resultant waste of fuel. The Mercoid control will stop the stoker from the increase in stack temperature, and the boiler will continue to absorb the heat from the glowing fire bed. When the stack temperature lowers sufficiently the Mercoid control will again start the stoker. This operation will be repeated until the thermostat cuts off.

The Type M-61 Mercoid Stoker Control is identical to the Type M-61 except that it breaks the circuit on a dropping temperature. This control can be employed as an additional safety where required and so set that it will open the circuit and stop the stoker operation in the event the temperature should drop below 150° F. This lower temperature would be reached only in the event the fire had gone completely out and this control would prevent the stoker from running continually and filling the boiler with fresh coal. A snap switch connected around this control would permit operation of the stoker while the fire was being started.



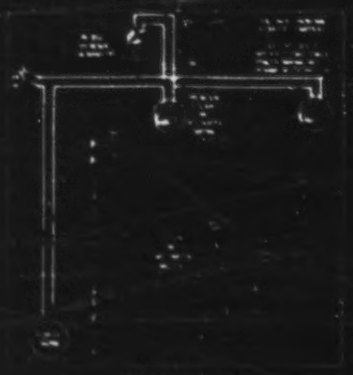
## Type M-51 and M-52 Warm Air Furnace Controls

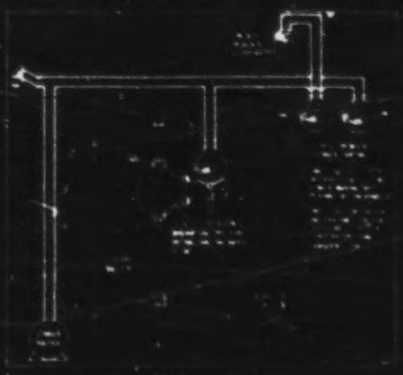
The Type M-51 Mercoid Control has been designed to prevent the overheating of stoker fired warm air furnaces.

It is identically the same as the Fig. M-61 stoker control, except that it has an adjustable mounting flange and a longer sleeve which permits the bimetal operating coil to extend farther into the furnace. By means of the adjustable flange the instrument can be easily installed on any furnace hood where the angle is from 30 to 90 degrees.

The Type M-52 Mercoid Control is identically the same as the Type M-51, except that it has two separate circuits, the one closing on a dropping temperature and the other on a rising temperature.

On a stoker fired warm air furnace equipped with an air circulating fan, this control serves a dual purpose. It will intermittently fire the stoker for short periods at a time when the thermostat is in the "off" position and will permit operation of the circulating fan only when the thermostat is calling for heat and the furnace is heated. See wiring diagram No. 3.





LIST PRICES

| | Single Pole | Double Pole | Two Circuit |
|---|---|---|---|
| Type M-61 Stoker Control, 10 Amp | $ | $ | |
| Type M-61 Stoker Control, 10 Amp | | | |
| Type M-51 Furnace Control, 10 Amp | | | |
| Type M-52 Furnace Control, 10 Amp | | | $ |

Shipping Weight, 4 lbs. 14 oz.

# Plaintiff's Exhibit 30

# MERCOID COAL STOKER CONTROLS

EQUIPPED WITH THE MERCOID SEALED MERCURY CONTACT SWITCH

TV2 STOK-A-TIMER

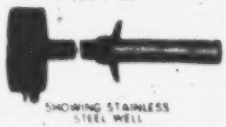
## TYPE TV2 MERCOID STOK-A-TIMER

A compact unit combining the Mercoid Transformer relay and a synchronous motor timer mechanism for maintaining the stoker fire during periods when the thermostat does not call for heat. This instrument incorporates the following important features:
**CANNOT OPERATE IMMEDIATELY AFTER THERMOSTAT SHUTS OFF**: A mechanical interlocking mechanism prevents it from operating the stoker immediately after the thermostat shuts off. This prevents overheating and waste of fuel.
**INTERVAL ADJUSTMENT**: Can be set for ½ hr. or 1 hr. interval merely by moving a lever to the position desired. No change of cams is required.
**FIRE MAINTAINING PERIOD**: Adjustable on graduated dial from 30 sec. to 12 min. A pointer can be moved by hand to the position desired.
**LOW VOLTAGE RELAY**: The Mercoid Transformer Relay built into this control induces its own low voltage on the thermostat circuit and is absolutely quiet in operation.
**MERCOID MERCURY CONTACT SWITCHES**: Eliminate unnecessary service as the contacts cannot be affected by dust, dirt or corrosive gases.
**ELECTRICAL CAPACITY**: Standard for 10 amp. 115V., 60 cycle. Available at no extra charge for 5 amp. 230V., 60 cycle.
**MOTOR RATING**: 1 H.P. Repulsion-Induction, ¼ H.P. Split Phase.

| TYPE NO | VOLTAGE | CODE | LIST PRICE |
|---|---|---|---|
| TV2-3A | 115V., 60cyc | uvgun | $18.00 |
| TV2-3B | 115V., 50cyc | uvgwy | 18.00 |
| TV2-3D | 115V., 25cyc | uvgya | 18.00 |
| TV2-3F | 230V., 60cyc | uvhap | 18.00 |
| TV2-3G | 230V., 50cyc | uvhcr | 18.00 |
| TV2-3J | 230V., 25cyc | uvhds | 18.00 |

Shipping weight 5 lbs.

TYPE M-63SW OUTFIRE STOKER CONTROL



SHOWING STAINLESS STEEL WELL

## TYPE M-63SW OUTFIRE STOKER CONTROL

Type M-63SW is a stack mounted, temperature operated control, designed to automatically stop the stoker in event the fire should go out or the fuel become exhausted. This prevents operating an empty stoker and guards against filling the combustion chamber with unburned fuel—a condition most unpleasant to the operator.
The Mercoid switch is of the enclosed mercury contact type. It is not subject to open arcing, corrosion, oxidation, or pitting and will operate indefinitely without deterioration. The mechanism of this control has many outstanding features. The dial, located in the center of the instrument, slowly rotates as the temperature on the bi-metal coil increases or decreases. This dial is clearly calibrated from 50 to 650°F., and a pointer indicates the temperature in the stack,—enabling the installation or service man to check the operation.
A simple double adjustment is provided for setting both the "high" and "low" operating points. The range can be adjusted over the entire scale, and the differential can be set for very close operation. The usual setting is approximately 100°F.
Standard instruments are furnished with a stainless steel well enclosing the bi-metal operating coil. This protects the coil not only from deposits of fly ash, but also against corrosive stack gases.
Furnished standard with a lock type manual switch button to permit starting the stoker after the fire has gone out. Turning the button locks the switch in the "on" position. When the fire is again started the stack temperature rises and the manual switch automatically unlatches and restores the control to normal operation.
**ELECTRICAL CAPACITY**: 10 amp. 115V., 5 amp. 230V. either A.C. or D.C.
**MOTOR RATING**: 1 H.P. Repulsion-Induction, ½ H.P. Split Phase or D.C.

| TYPE NO | RANGE ADJ | CODE | LIST PRICE |
|---|---|---|---|
| M-63SW | 50-650° F | uvosy | $18.50 |

Shipping weight approx. 4½ lbs.

JMV STOKATHERM

## TYPE JMV MERCOID STOKATHERM

The STOKATHERM, is based on a new principle of operation. It combines the advantages of Timer and stack controls, and at the same time overcomes the former weaknesses and disadvantages of these devices. Note the following important features:
**FIRE MAINTAINING**: The Stokatherm, operates the stoker for only the very shortest periods necessary to maintain a minimum fire while the thermostat is in the off position.
**LIMITS OVERHEATING**: The firing periods, being directly responsive to combustion conditions, are not at definitely timed intervals or governed by fixed stack temperatures, but are automatically regulated to meet the variable conditions encountered.
**FUEL SAVING**: As domestic stokers operate approximately 80% of the heating season on the fire maintaining controls, the economical, short operations of the Stokatherm not only result in a very decided fuel saving, but also insure against overheating.
**OUT-FIRE OPERATION**: Should the fuel become exhausted, or the fire go out, the Type JMV Stokatherm automatically stops the stoker. This prevents operating an empty stoker and guards against filling the combustion chamber with unburned fuel.
**LOW VOLTAGE RELAY**: The Mercoid Transformer Relay built into this control induces its own low voltage on the thermostat circuit and is absolutely quiet in operation.
**MERCOID MERCURY CONTACT SWITCHES**: Eliminate unnecessary service as the contacts cannot be affected by dust, dirt or corrosive gases.
**ELECTRICAL CAPACITY AND MOTOR RATING**: Same as TV2 above.

| TYPE NO | VOLTAGE | CODE | LIST PRICE |
|---|---|---|---|
| JMV-3A | 115V., 60cyc | uvhet | $28.00 |
| JMV-3B | 115V., 50cyc | uvhfu | 30.00 |
| JMV-3D | 115V., 25cyc | uvhix | 30.00 |
| JMV-3F | 230V., 60cyc | uvhiy | 28.00 |
| JMV-3G | 230V., 50cyc | uvhia | 30.00 |
| JMV-3J | 230V., 25cyc | uyhod | 30.00 |

Shipping weight 9 lbs.

# STOKER CONTROLS FOR APARTMENTS, HOTELS OR FACTORIES

T2 STOK-A-TIMER

## TYPE T2 MERCOID STOK-A-TIMER

The STOK-A-TIMER is recommended for industrial applications such as in apartment buildings, hotels, etc., where no thermostat is employed but where it is desired to maintain the fire during mild days or night periods when heating is not required.
During periods when heat is required the stoker operation is governed entirely by the boiler limit control. When heating is not required the STOK-A-TIMER can be connected into the circuit either automatically by means of an electric time switch, or by manually throwing a switch. The stoker will then operate periodically for short intervals as required to prevent the fire going out.
The Type T2 STOK-A-TIMER consists of a synchronous motor timer mechanism which actuates a Mercoid switch. It incorporates the following important features:
**SYNCHRONOUS MOTOR**: Self starting type of the highest quality, enclosed in dust tight case with sealed in lubrication.
**INTERVAL ADJUSTMENT**: The interval between firing periods can be adjusted from ½ hr. to 1 hr. by moving lever to position desired. No change of cams is required.
**FIRE MAINTAINING PERIOD**: The length of time the stoker fires at each operation is adjustable from 30 sec. to 12 min. A pointer can be moved by hand to the time desired as shown on the calibrated dial.
**MERCOID SWITCH**: The Mercoid sealed mercury contact switch eliminates unnecessary service as the contacts cannot be affected by dust, dirt or corrosive gases.
**AMPLE WIRING SPACE** is provided for making connections to terminal posts.
**ELECTRICAL CAPACITY AND MOTOR RATING**: Same as Type TV2 above.

| TYPE NO | VOLTAGE | CODE | LIST PRICE |
|---|---|---|---|
| T2-A | 115V. 60cyc | uvhpe | $17.00 |
| T2-B | 115V., 50cyc | uvhsh | 18.00 |
| T2-D | 115V. 25cyc | uvhti | 18.50 |
| T2-F | 230V. 60cyc | uvhui | 17.00 |
| T2-G | 230V. 50cyc | uvhyn | 18.00 |
| T2-J | 230V. 25cyc | uvhzo | 18.50 |

Shipping weight approx. 4 lbs.

896 PLAINTIFF'S EXHIBIT 31.

(Letterhead of Richard Spencer, Chicago.)

July 15, 1940.

Mr. Langdon Moore,
53 West Jackson Blvd.,
Chicago, Illinois.

My dear Mr. Moore:

In accordance with our telephone conversation this morning, kindly be advised that I have been authorized to negotiate a license with Mercoid Company on the following terms. A non-exclusive license will be granted under the stoker control patent involved in the Smith v. Mid-Continent litigation, and in return Mercoid will pay Five Thousand Dollars ($5000) for past infringement and One Dollar ($1.00) per unit, looking toward future installations during the life of the patent.

Very truly yours,

RS:CT

TT32

**Plaintiff's Exhibit 32**

JAMES ATKINS

LAW OFFICES OF
LANGDON MOORE

BLOOMINGTON ILL. CHICAGO, ILL. WASHINGTON, D. C.

PATENTS
TRADE MARK AND
UNFAIR COMPETITION
CAUSES

Chicago, Illinois
July 16, 1940

Mr. Richard Spencer
135 South La Salle Street
Chicago, Illinois

Re: Mercoid and
Mid-Continent

Dear Mr. Spencer:

I wish to thank you for your letter of July 15, 1940 stating that you have been authorized to negotiate a license with Mercoid. I understand from your letter that Mid-Continent is willing to grant Mercoid a non-exclusive license under the Cross patent No. 1,758,146, May 13, 1930, which was involved in the Smith vs. Mid-Continent litigation for and in consideration of Five Thousand Dollars ($5000) to be paid by Mercoid for past infringement and One Dollar ($1.00) per unit for future installations during the life of the patent.

I have submitted your letter to Mercoid for its consideration and Mercoid has requested me before it accepts or declines to accept the license that you be more specific as to what you mean by "Future installations during the life of the patent".

I do not know how familiar you are with the present situation and therefore feel that a little explanation on my part will give you a better understanding as to the reason Mercoid wishes to have "future installations" explained more fully.

Mercoid makes and sells two heat responsive control switches which are referred to as M-51 and M-71. The mechanisms of these switches are identical in construction and operation and each may be adjusted to open the circuit at a predetermined high temperature and close the circuit at a predetermined low tempera-

ture. Both switches are operated by a coil of by-metallic metal adapted to be inserted within the bonnet of a warm air furnace or in the stack of a steam or hot water furnace so that each is responsive to the fluctuations in temperature of the burning fuel. The only difference between these two controls is that the thermo or by-metallic coil of the M-51 control is longer than the thermo or by-metallic coil of the M-61 control. The thermo or by-metallic coil of the M-61 control is shorter so that it may be located within the stack of the furnace and when desired, a stainless steel protecting well may be placed over the by-metallic coil.

Mercoid desires to know if Mid-Continent considers the sale of Mercoid M-51 control and Mercoid M-61 control by Mercoid to contribute to the infringement of the Cross patent No. 1,758,146, so that if Mercoid executed the proposed license it would be expected to pay a royalty on each of these controls sold.

In order that Mercoid may be acting under no misapprehension as to the scope of the proposed license, I would request that you reply by letter so that there can be no misunderstanding between Mercoid and Mid-Continent.

With kind regards, I am

Cordially yours,

Langdon Moore

LM:fh

899 PLAINTIFF'S EXHIBIT 33.

(Letterhead of Richard Spencer, Chicago.)

July 17, 1940.

Mr. Langdon Moore,
53 West Jackson Blvd.,
Chicago, Illinois.

Re: Mercoid & Mid-Continent

My dear Mr. Moore:

In answer to your letter of July 16, 1940, it is my impression that Mercoid control M-61 is primarily employed for fire bed maintenance, whereas, type M-51 is customarily employed to control the temperature of the furnace casing. Our opinion is that controls of the former type fall within the scope of the Cross patent, whereas, controls of the latter type do not. Accordingly, we would expect your Company to pay license fees on type M-61 in instances in which the controls are employed for fire bed maintenance, but would not expect to receive royalties on type M-51 where that type is employed for purposes of controlling the temperature of the furnace casing. However, if the latter control should be employed for purposes of fire bed maintenance, then if also would come within the purview of the Cross patent.

I understand that Mercoid does not actually install the controls, and I realize that it might be difficult for Mercoid in all instances to ascertain the use to which the control is to be put. However, other licensees, both past and present, have accounted to Mid-Continent for controls, so apparently it is not an impossible task.

The license should provide for the payment of the royalty mentioned on the sale of all controls employed in a system or arrangement of the type set forth in the adjudicated claims and should further provide that in the event of a disagreement between Licensor and Licensee concerning the question of whether a particular type of control is or is not employed in an infringing manner, the question can be settled by arbitration.

900 If the premises thus far outlined meet with your approval and with the approval of your principal, please let me know and I will prepare and forward to you a preliminary draft of a license agreement.

Sincerely yours,

RS:CT

901 PLAINTIFF'S EXHIBIT 34.

(Letterhead of Langdon Moore, Chicago.)

Chicago, Illinois
July 18, 1940.

Mr. Richard Spencer,
135 South La Salle Street,
Chicago, Illinois.

Re: Mercoid and Mid-Continent

Dear Mr. Spencer:

Your letter of July 17, 1940 in regard to a proposed license under the Cross patent was received this morning and I read your letter over the telephone to Mr. McCabe.

Inasmuch as you state that Mid-Continent would not expect royalties on type M-51 where that type is employed for purposes of controlling the temperature of the furnace casing but if this type M-51 were to be employed for purposes of fire maintenance then it would also come within the purview of the Cross patent, and provided for settlement by arbitration, my client feels it should be able to consider the exact wording of such an agreement before it advises Mid-Continent definitely whether or not a settlement will be agreeable to Mercoid.

As you have offered to prepare and forward to me a preliminary draft of such a license agreement, I believe that it would simplify matters considerably if you would do so and place the terms in your letter of July 17, 1940 in the form of a license.

With kindest personal regards, I am

Cordially yours,
Langdon Moore
Langdon Moore

LM:fh

902 PLAINTIFF'S EXHIBIT 35.

(Letter of Langdon Moore, Chicago, Ill.)

Chicago, Illinois,
July 24, 1940.

Mr. Richard Spencer,
135 South La Salle Street,
Chicago, Illinois.

Re: Mercoid & Mid-Continent.

Dear Mr. Spencer:

I wish to thank you for your letter of July 23, 1940 enclosing draft of a proposed license between the above mentioned parties and I am forwarding the same to the Mercoid today.

If Mr. Courteol and Mr. McCabe are both in town I should be able to give you the reaction of the Mercoid Corporation to the proposed license by the end of this week or the next.

With my kindest personal regards, I am

Cordially yours,

Langdon Moore.

Langdon Moore.

LM:fh

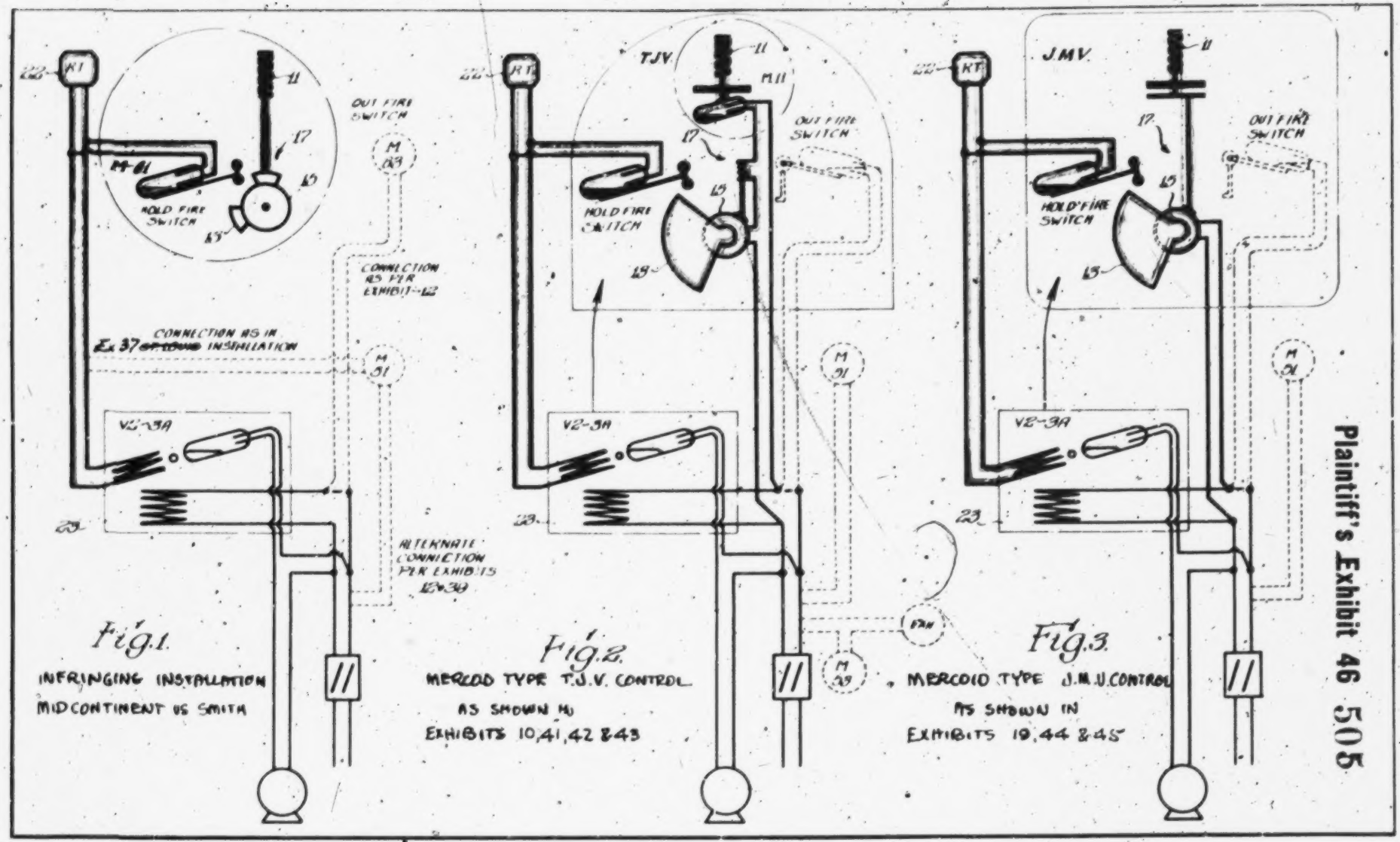



Fig.1.
INFRINGING INSTALLATION
MIDCONTINENT VS SMITH

Fig.2.
MERCOID TYPE T.J.V. CONTROL
AS SHOWN IN
EXHIBITS 10, 41, 42 & 43

Fig.3.
MERCOID TYPE J.M.V. CONTROL
AS SHOWN IN
EXHIBITS 19, 44 & 45

Plaintiff's Exhibit 46 505

# RELAYS—ELECTRIC TIME SWITCHES

ALL INSTRUMENTS EQUIPPED WITH THE MERCOID SEALED MERCURY CONTACT SWITCH

**Plaintiff's Exhibit 48**

## TYPE V TRANSFORMER—RELAY

The Mercoid Type V Transformer Relay is outstanding in performance. It is highly recommended for all applications requiring a very quiet and dependable mercury contact relay, with low voltage thermostat or pilot circuit. This relay is ideal for use with automatic heaters on boilers, electric heaters, refrigeration or air conditioning equipment, where quietness and dependability for long periods are essential.

The principle of operation is entirely different from conventional clapper type relays. The Type V relay has a fixed primary coil and a movable secondary coil. The transformer is self contained in the relay, so the primary coil induces 24 volts in the secondary coil. Current flows when the low voltage circuit is closed, magnetic repulsion moves the secondary coil upward and closes the Mercoid switch circuit. There are no moving parts to burn or chatter. The Mercoid mercury contacts cannot pit, burn or stick, nor can they be held open by residual magnetism.

**SINGLE POLE RELAYS**

**TYPE V2-3A:** 110 V. 60 Cyc., 10 Amp. (Load circuit common to supply circuit.)

**TYPE V2-3A 108:** 110 V. 60 Cyc., 10 Amp. (Load circuit separate from supply circuit.)

**TYPE V2-3F:** 220 V. 60 Cyc., 5 Amp. (Load circuit common to supply circuit.)

**TYPE V2-3F108:** 220 V. 60 Cyc., 5 Amp. (Load circuit separate from supply circuit.)

**MOTOR RATING** (ALL ABOVE TYPES): ½ H.P. Repulsion Induction, ¼ H.P. Split Phase.

**MULTI-POLE RELAYS** Available Double Pole, Triple Pole, Single Pole Double Throw, Double Pole Double Throw and in many other circuit arrangements and electrical ratings. Also available as dual relays for air conditioning work. Prices on application.

**ODD VOLTAGES AND CYCLES** All A.C. relays available for 110 or 220V. 50 or 60 cycle at extra charge of $.50 each unit. For other odd voltages and cycles, prices on application.

**DIRECT CURRENT RELAYS** All D.C. relays require special voltage pilot to thermostat.

**TYPE V2-3E:** 110v. D.C., 10 Amp. (Load circuit common to supply circuit.)

**TYPE V2-3K:** 220v D.C., 5 Amp. (Load circuit common to supply circuit.)

**MOTOR LOAD** ¼ H.P. D.C.

For D.C. relays add $.50 each unit.

**SIZE** All relays are furnished in black crystal bakelite, round glass cover. Depth 2⅝". Width 4". Height 6⅛". On special order any type may be furnished without base (panel mount) at reduced prices.

| SPECIFICATIONS | LIST PRICE |
|---|---|
| Type V2-3A, 10 amp., 110 V-60 cyc. | $9.00 |
| Type V2-3A 108, 10 amp., 110V-60 cyc. | 9.00 |
| Type V2-3F, 5 amp., 220V-60 cyc. | 9.00 |
| Type V2-3F 108, 5 amp., 220V-60 cyc. | 9.00 |

Shipping weight 3 lbs., 9 oz.

For complete information refer to Catalog Bulletin No. 110

## MERCOID TRIPLEX ELECTRIC TIME SWITCHES

The Mercoid Triplex Time Switch is operated by a self starting synchronous motor. The workmanship and the highest quality, with heavy cut brass wheels having persons of the highest grade steel.

This switch is extremely useful in controlling show window lights, poster boards, sign lights, etc., and has many other applications in industrial fields.

The "On" and "Off" contacts are independently set by means of adjustable clamps on the dial ring. The Mercoid mercury contact switch is operated by a positive

**TYPE 201:** SINGLE POLE, SINGLE THROW, 24 HR. RIM.

**TYPE 202:** SINGLE POLE, DOUBLE THROW, 24 HR. RIM.

**TYPE 402:** DOUBLE POLE, SINGLE THROW, 24 HR. RIM.

**ELECTRICAL CAPACITY** (All above types)

Motor load A.C. inductive units (not including 10 amp. 110V., 5 amp. 220V. lamp load) 1 H.P. (other loads open circuit) 20 amp. 110 or 220V.

**TIME SWITCHES FOR DAY AND NIGHT TEMPERATURE CONTROL WITH DUAL SENSATHERM**

**TYPE T-10:** For use with Dual Sensatherm when Type V Transformer Relay is incorporated in other control units such as KM or KMI Pyratherm. This switch has 24 hour dial and is furnished with one set On and Off clamps.

**TYPE T-710:** Same as Type T-10 except has seven day dial. (See below under "Seven day dial for week end shut off or odd daily programs.")

**TYPE T-10V2:** Same as Type T-10 except Type V Relay is incorporated within time switch case.

**TYPE T-710V2:** Same as T-10V2 except has seven day dial.

**7 DAY DIAL FOR WEEK-END SHUT OFF OR ODD DAILY PROGRAMS**

All time switches can be furnished with 7 day program rim and seven sets of ON and OFF clamps. The rim makes one revolution in 7 days and daily program can vary from day to day to meet odd programs and any daily operations may be omitted to meet week end or holiday requirements.

Especially recommended for factories, churches, schools, libraries etc., where lowered temperatures are desirable over week ends or holidays or at irregular daily periods.

| SPECIFICATIONS | LIST PRICE |
|---|---|
| Type 201 | $25.50 |
| Type 202 | 30.00 |
| Type 402 | 30.00 |
| Type T-10 | 25.50 |
| Type T-710 | 33.00 |
| Type T-10V2 | 34.50 |
| Type T-710V2 | 42.00 |

When ordering be sure and specify whether for 110 or 220V., 50 cycle.

Shipping weight without relay, approx. 7 lbs.; with relay, approx. 13 lbs.

For complete information refer to Catalog Bulletin No. 115B

# THE MERCOID CORPORATION

564 WEST ADAMS STREET

CHICAGO, U.S.A.

NEW YORK OFFICE
25 CHURCH STREET
SAN FRANCISCO OFFICE
128 FOLSOM ST

COMBINED INDUSTRIES
THE FEDERAL BAUBE COMPANY
ARCLESS CONTACT COMPANY
CABLE ADDRESS "MERCOID" CHICAGO

February 26, 1930.

Dear Sirs:

We believe that the features embodied in the Mercoid M-53 Furnace Fan Control will appeal to you, and we refer you to the enclosed circular, illustrating and describing it.

Used in conjunction with your equipment, where booster-fans are employed, it will give you assured satisfaction.

The unfailing performance of Mercoid Controls reduces unnecessary service expense. We stand back of our product and trust we may have your favorable consideration when you need equipment of this kind.

Please bear in mind that you may use this control without fear of infringement, for any and all warm air furnace fan applications, through our licenbe under patent reissue No. 15,531.

We hope we may hear from you on this subject, and remain,

Yours very truly,

THE MERCOID CORPORATION

J. W. Owens

JWO:S-V

VICE PRESIDENT.

**Defendant's Exhibit A**

MERCOID SWITCH
FEDERAL
WARRANTED
CHICAGO-MARSHALLTOWN
TRADE MARK

MERCOID BULLETIN **E1**

MARCH 1925

# FEDERAL MERCOID THERMOSTATS

Listed as Standard by Underwriters' Laboratories, Inc.

## Designed Especially for Automatic Heating Equipment

Contact is made within the Federal Mercoid sealed glass tube, containing inert gases and mercury.

Has no exposed conducting surfaces, eliminating corrosion, oxidation and open arc.

The Federal Mercoid Tube is actuated by a sealed metal bellows, containing expansive liquids or gases.

Accurate and positive in operation.

Protected by brass cover having hard rubber finish.

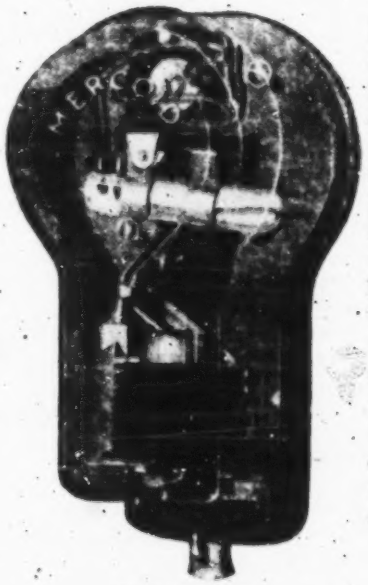



FIGURE 21

FEDERAL MERCOID THERMOSTATS will automatically control Motors of one horsepower or less, within guaranteed ratings, for normal working load of 10 amperes at 110 volts or 5 amperes at 220 volts (or their equivalents), *either A. C. or D. C.*, thereby eliminating the use of relays or remote controls. As a pilot switch, may be used to control any size motor.

Regularly furnished with standard scale 56° to 80° F., with a guaranteed operating differential of 2°.

Adjustable to open and close the circuit at any point within its range

## List Prices for Standard Range Thermostats:

| | Figure 21 |
|---|---|
| Single Pole Type | $40.00 each |
| Two-circuit " (3-wire, or single pole and alarm) | 45.40 " |
| Single Pole and Momentary Contact Type | 45.40 " |
| Two-pole Type | 50.00 " |
| For Ranges Other Than Standard add to above lists | 10.00 each |

THE FEDERAL GAUGE COMPANY
564 WEST ADAMS STREET
CHICAGO, ILL., U. S. A.

PATENTS PENDING

Printed in U. S. A.

# FEDERAL MERCOID BOILER CONTROLS

## Pressure Type

As safety limiting devices, Federal Mercoid Boiler Controls are positive, accurate and reliable.

May be used for circuit breaker on motors of one horsepower or less.

Regularly furnished with ¼" male bottom connection.

FIGURE 31

Steam Switches must be siphoned (use an ordinary pig-tail or any other efficient siphon).

Furnished with semi-glass front and steel ring, or all metal cover.

BX or conduit connection furnished where specified.

### STANDARD RANGES

| | | | |
|---|---|---|---|
| 0 to 2 lb. | and adjustable up to | 1 to 3 lb. |
| ½ to 3 lb. | " " | 2 to 4½ lb. |
| 1 to 4 lb. | " " | 5 to 8 lb. |
| 5 to 8 lb. | " " | 9 to 12 lb. |
| 10 to 15 lb. | " " | 15 to 20 lb. |

When furnished for pressures above 15 lbs. and up to 35 lbs. the minimum operating differential is 5 lbs. Pressures above 35 lbs. and not exceeding 100 lbs. require a 10 lb. operating differential. When Mercoid pressure controls are furnished for pressures higher than 100 lbs. a minimum operating differential of approximately 20% of the high point is required.

# IMMERSION TYPE BOILER CONTROLS

### Straight Stem Temperature Type

FIGURE 36

¼" male conn and 6" stem
or
⅜" male conn and 3" stem

Standard Range, 140° to 180° F., adjustable up to 175° to 200° F. For lower temperature work the standard range is 140° to 160° F. adjustable up to 160° to 180° F. For Vapor or Steam Boiler Control the standard range is 200° to 214° F., adjustable up to 214° to 226° F.

Federal Mercoid Boiler Controls have a set operating differential but the high and low points may be changed by loosening two small screws on each side of eccentric button on back of case. To lower the cutting out point turn button clockwise. To raise turn counter clockwise. After adjusting, screws must be tightened.

### Back Angle Stem Temperature Type

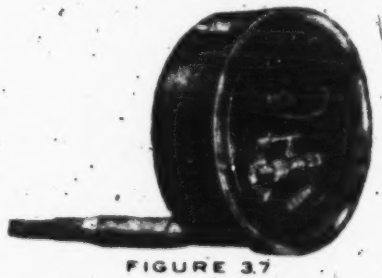


FIGURE 37

¼" male conn and 6" stem
or
⅜" male conn and 3" stem

**For List Prices on Above See Page Three of This Bulletin**

PATENTS PENDING

# MERCOID LEVER ARM TYPE CONTROLS

### Counterbalanced Type

FIGURE 40
For Maintaining fluid levels

### Lever Arm Overflow Type

(Top or Bottom Mounting)

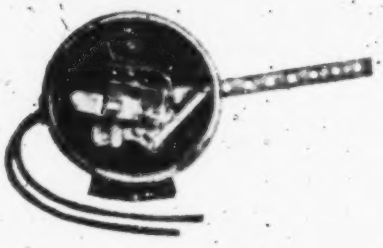


FIGURE 46

For final safety on overflow also on Vapor Heating Systems, close regulation may be obtained with this type of control, when used in connection with chain and weights on lever arm of Boiler Regulator.

Made to open or close circuit, with lever arm in up or down position.

Lever Arm Type, Figure 46, may be used as a sump switch or in connection with a cellar drainer. Positive, accurate and reliable, will automatically control directly, motors of one-horse-power or less, within guaranteed rating, for normal working load of 10 amperes at 110 volts or 5 amperes at 220 volts (or their equivalents), *either A. C. or D. C.*, thereby eliminating the use of relays or remote controls. As a pilot switch may be used to control any size motor.

## List Prices

| | Fig. 31 Each | Fig. 36 Each | Fig. 37 Each | Fig. 40 Each | Fig. 46 Each |
|---|---|---|---|---|---|
| Single Pole Type | $27.00 | $30.00 | $32.00 | $22.00 | $17.00 |
| Two-circuit (3-wire or S. P. and alarm) | 33.00 | 36.00 | 38.00 | 28.00 | 23.00 |
| Single Pole and Momentary Contact | 33.00 | 36.00 | 38.00 | 28.00 | 23.00 |
| Two-Pole Type | 37.00 | 40.00 | 42.00 | 32.00 | 27.00 |
| For Ranges other than Standard add | 5.00 | 10.00 | 10.00 | | |

PATENTS PENDING

MERCOID SWITCH
FEDERAL
[WARRANTED]
CHICAGO - MARSHALLTOWN
TRADE MARK

# FEDERAL MERCOID FURNACE CONTROL

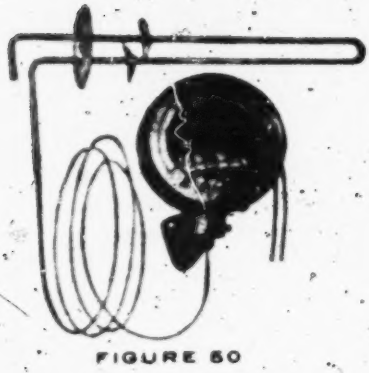


FIGURE 50

For automatic control on warm air furnaces.

Acts as safety device to prevent overheating of furnace.

Standard Range 250° to 300° F. Range may be adjusted by sliding loaded stem in or out of furnace hood above furnace dome, or by standard adjustment on back.

Furnished with bronze stem, charged with an expansive liquid, operating on the same principle as the Federal Mercoid Hot Water Boiler Control.

Equipped with bracket for wall fastening.

The Federal Mercoid Furnace Control has the same electrical rating as other Mercoid instruments, making relays unnecessary for currents up to 10 amperes at 110 volts or its equivalents.

## List Prices

| | Each |
|---|---|
| Single Pole | $40.00 |
| Two-circuit (3-wire or single pole and alarm) | 46.00 |
| Single Pole and Momentary Contact | 46.00 |
| Two-pole | 50.00 |

# FEDERAL MERCOID SWITCHES

Types illustrated below are furnished for other than Pressure, Vacuum or Thermostatic purposes

**Two Circuit**

FIGURE 2

**Single Circuit**

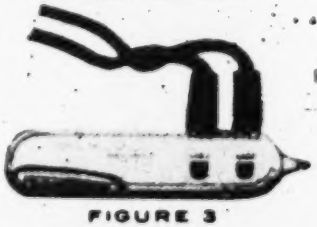


FIGURE 3

**Relay Type**

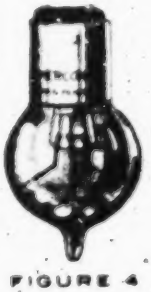


FIGURE 4

## LIST PRICES

| | |
|---|---|
| Figure 2 | $8.70 each |
| Figure 3 | 6.35 each |
| Figure 4 | 3.75 each |

PATENTS PENDING

512
BULLETIN D

Defendant's Exhibit C

FEDERAL

# MERCOID CONTROLS

**Data Sheet No. 1** **April 1, 1924**

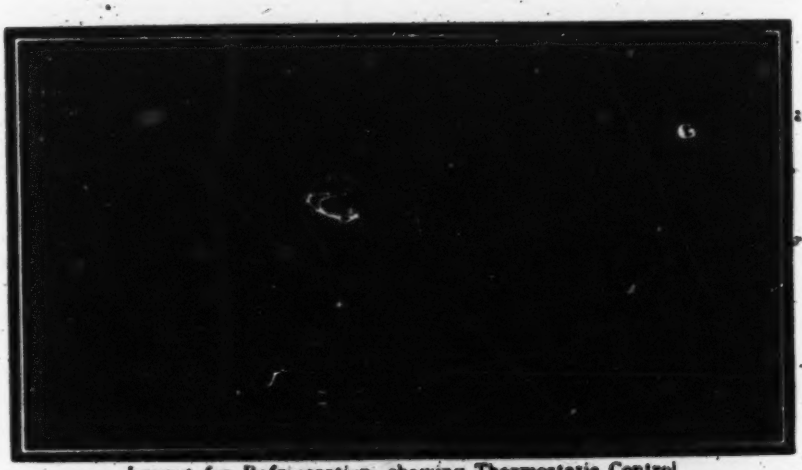
The accompanying diagrams illustrate a few of the many applications of the Mercoid Controls for temperature, pressure, etc., and show correct wiring diagrams. Mercoid Controls can be used for almost any work where it is desired to make and break an electric circuit according to temperature or pressure changes. Details of construction and operation of the Mercoid Thermostat are furnished in a special circular sent upon request.

Write us for additional information on Controls for special requirements, giving details of the the proposed application and statement of the work desired to be accomplished.

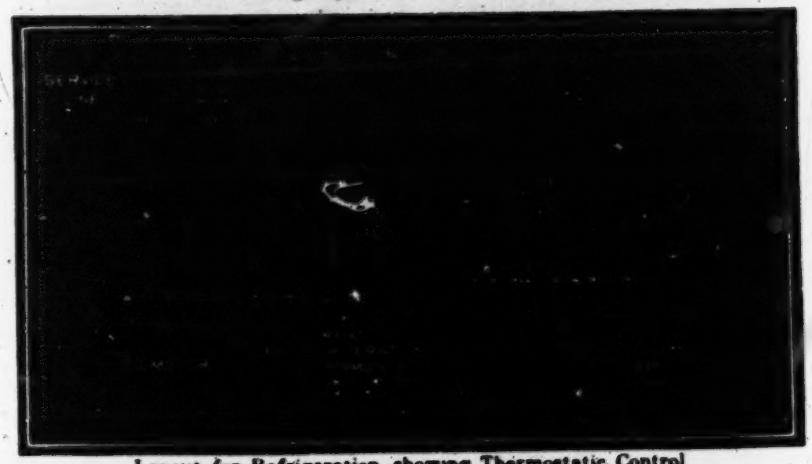
Typical Wiring Layout on Oil Burner

PATENTS PENDING

# MERCOID CONTROLS



Layout for Refrigeration, showing Thermostatic Control and Emergency Control on Water Pressure.

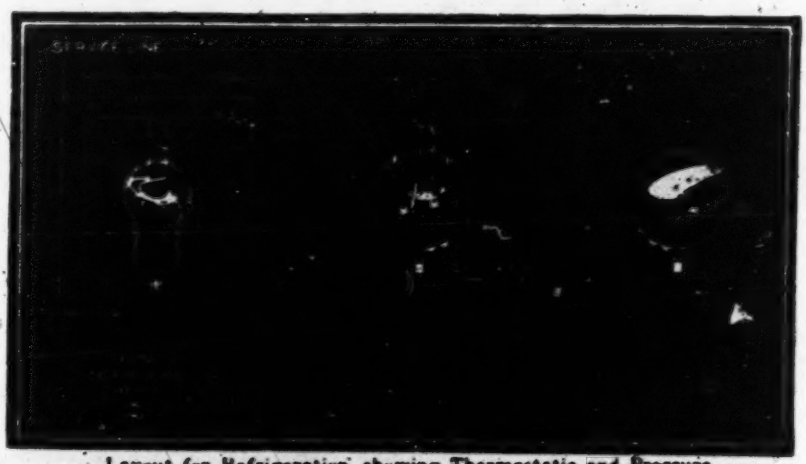


Layout for Refrigeration, showing Thermostatic Control and Emergency Control for Refrigerant.

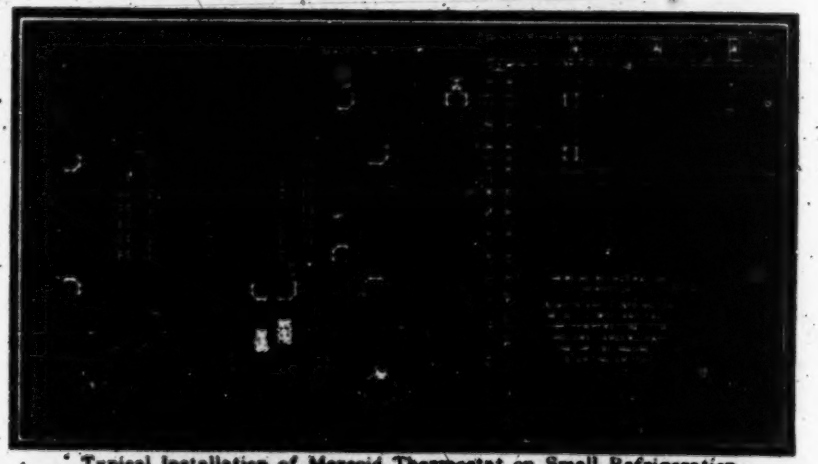
Layout for Refrigeration, showing Thermostatic Control and Combination of Emergency Pressure Controls on Water and Refrigerant

PATENTS PENDING

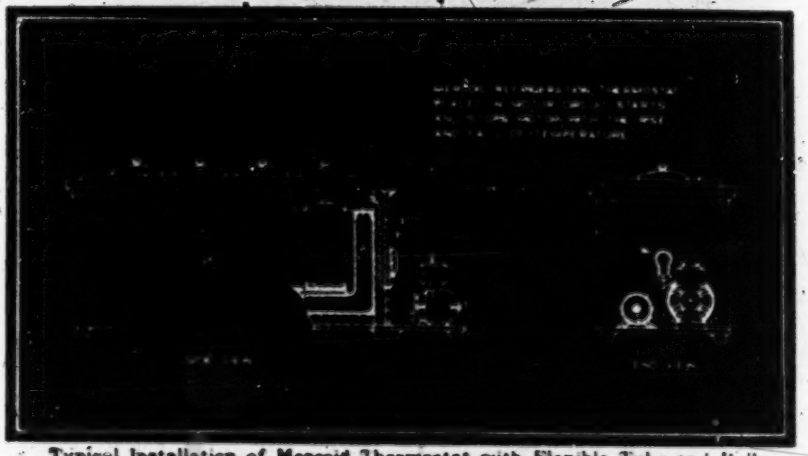
# MERCOID CONTROLS



Layout for Refrigeration, showing Thermostatic and Pressure Controls With Double Circuit Switch for Alarm.



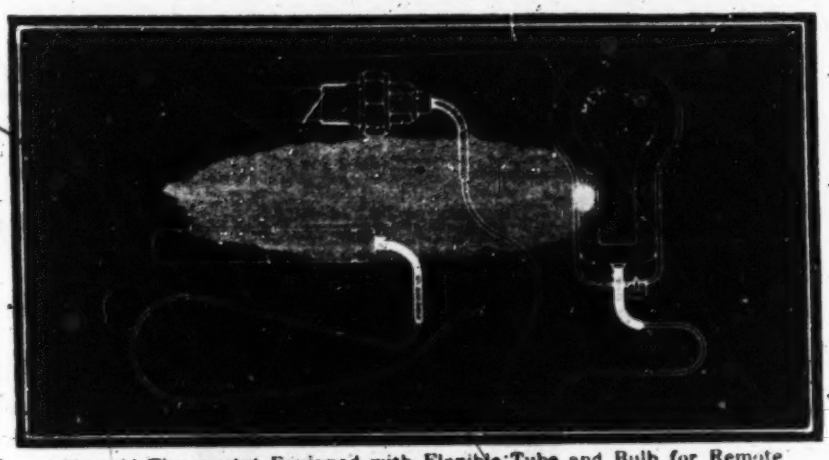
Typical Installation of Mercoid Thermostat on Small Refrigeration Unit. (Pressure Controls omitted).



Typical Installation of Mercoid Thermostat with Flexible Tube and Bulb on Ice Cream Cabinet. (Pressure Controls omitted).

PATENTS PENDING

# MERCOID CONTROLS



Mercoid Thermostat Equipped with Flexible Tube and Bulb for Remote Control. Supplied with or without 1" Standard Threaded Connection.

Mercoid Pressure Control 1/4" Connection. Can be Furnished to Operate at Pressures from 1 lbs. up.

Mercoid Hot Water Boiler Control 1/4" Connection. For Temperatures 175-200 degrees or Similar Range. Angle Connection on Special Order.

## THE FEDERAL GAUGE CO.

564 W. Adams Street

CHICAGO, ILL.

MERCOID SWITCH FEDERAL WARRANTED CHICAGO MARSHALLTOWN TRADE MARK

MERCOID SWITCH FEDERAL WARRANTED CHICAGO MARSHALLTOWN

PATENTS PENDING

## Defendant's Exhibit C-1

MERCOID BULLETIN C

MERCOID SWITCH
FEDERAL
WARRANTED
CHICAGO MARSHALLTOWN
TRADE MARK

APRIL 1923

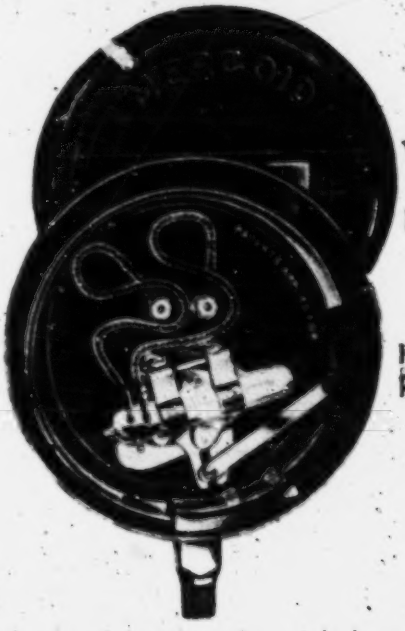
# FEDERAL MERCOID SWITCHES

FOR

## Automatic Electric Control
## Pressure, Vacuum and Thermostatic

**Thousands of Combinations**

Water Systems
Float Switches
Hot Water and Steam Boiler Controls for Oil Burners
Bearing Protection Devices



**Types for Various Service**

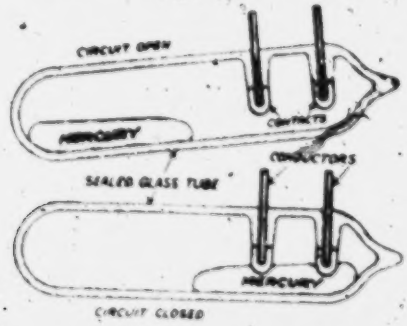
Refrigeration Controls
Both Pressure and Thermostatic
also
High Pressure Cutouts
Railroad Water Tower Switches
Sign Flashers

Close Range Vacuum Switches

Room Temperature Controls

Also made semi-automatic with hand reset

## Accurate and Positive in Operation




**Circuit completed in sealed glass tube, containing inert gas and mercury.**

***Many Types of Tubes Available***

## NO Arcing — NO Oxidation of Contacts

PRICES ON APPLICATION

MERCOID SWITCH
FEDERAL
WARRANTED
CHICAGO-MARSHALLTOWN
TRADE MARK

# FEDERAL MERCOID THERMOSTATS

## Industrial Refrigeration Domestic

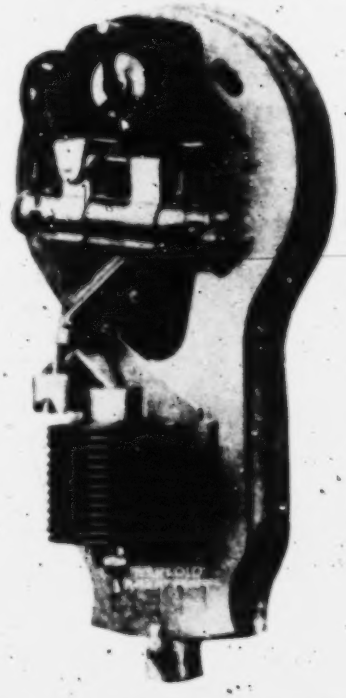
Federal Mercoid Sealed Glass Tube, containing inert gas and mercury.

No exposed conducting surfaces.

No corrosion, no open arc, no oxidation.

Adjustable to open and close the circuit at any point within its range, with an operating differential as close as one degree.

Furnished with flexible stem on bellows when used for brine tank control.



Mercoid Tube actuated by sealed metal bellows, containing expansive liquids or gases.

Protected by metal cover, having hard rubber finish.

Mercoid Controls are especially adapted to electrically operated and controlled oil-burning equipment, refrigeration, general domestic and industrial work.

# FEDERAL MERCOID BOILER CONTROLS

Bourdon Tube Type Temperature Controls for hot water boilers and vapor heating systems, made with vertical stem, or (when specified) with right or left angle stem.

All ¼" Boiler Connections

Bourdon Tube Type Pressure Controls, for steam boilers, made for controlling pressures, with ranges from two pounds up.

Mercoid Controls will safely carry loads of 10 amperes at 110 volts or less, and 5 amperes at 220 volts, either A. C. or D. C., thereby eliminating the use of remote control on motors of one horsepower or less.

THE FEDERAL GAUGE COMPANY
AND MARSHALLTOWN MANUFACTURING CO.

ADDRESS ALL CORRESPONDENCE TO 564 WEST ADAMS ST., CHICAGO, ILL.

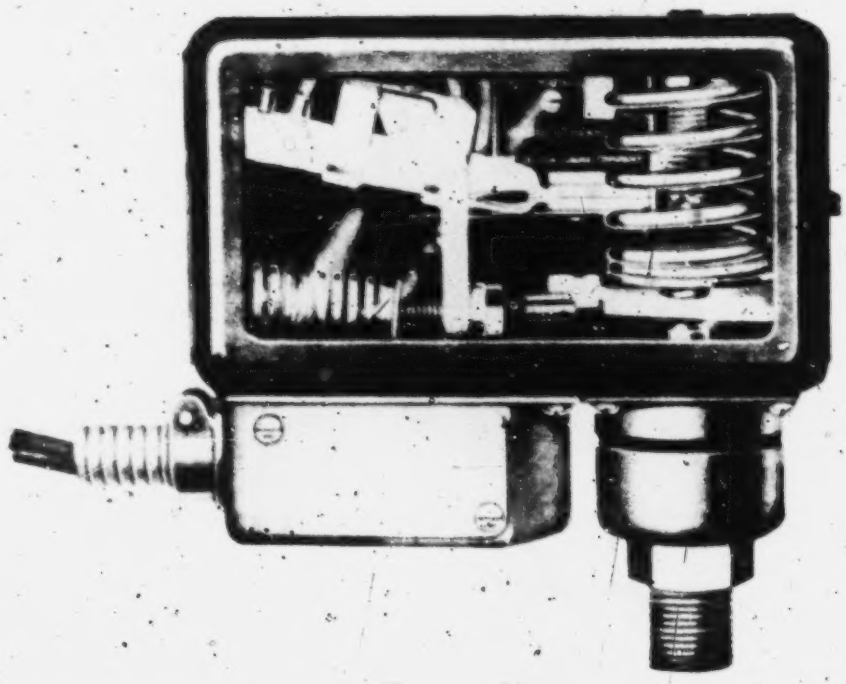
**Defendant's Exhibit D**

No. 848

# MERCOID CONTROL

## Industrial Type

Pat. Issued 1598874, 1640869, 1658013. Others Pending.



SINGLE CIRCUIT, SINGLE POLE TYPE

Automatically opens or closes circuit by change of temperature, pressure or vacuum. Easily adjustable as to operating range and closeness of control. For 110 or 220 volt current A. C. or D. C.

MERCOID

## The Mercoid Corporation

564 West Adams St.
Chicago, Ill.

# THE No. 848 MERCOID CONTROL

519

1. Steel case, rust proofed. Cadmium plate finish. Hinged glass cover.

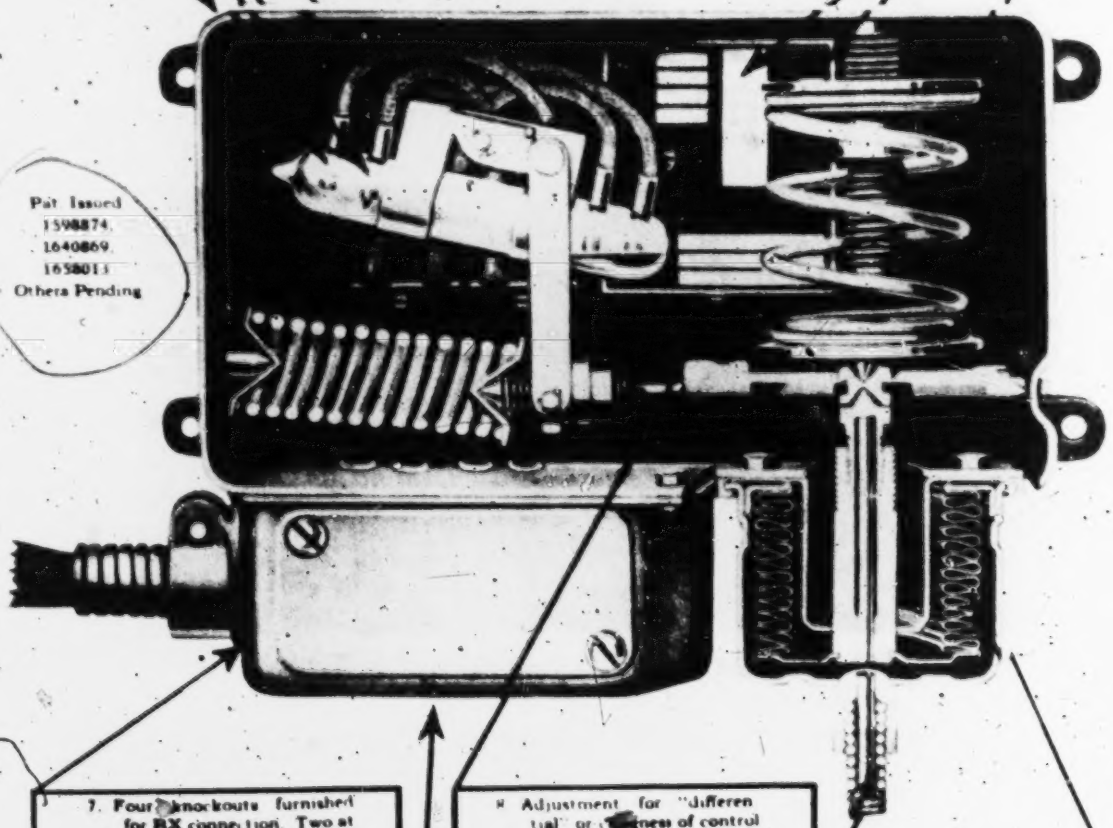
2. Contacts of special material. No corrosion. No exposed arc.

3. Flexible lead wires of approved size and type.

4. Adjustment for operating point by turning this cap.

5. Graduations on name plate show operating point.

6. Adjustable range stamped on name plate.



Pat. Issued
1598874.
1640869.
1658013.
Others Pending.

7. Four knockouts furnished for BX connection. Two at bottom, one at end, one at back.

8. Adjustment for "differential" or closeness of control by turning this screw.

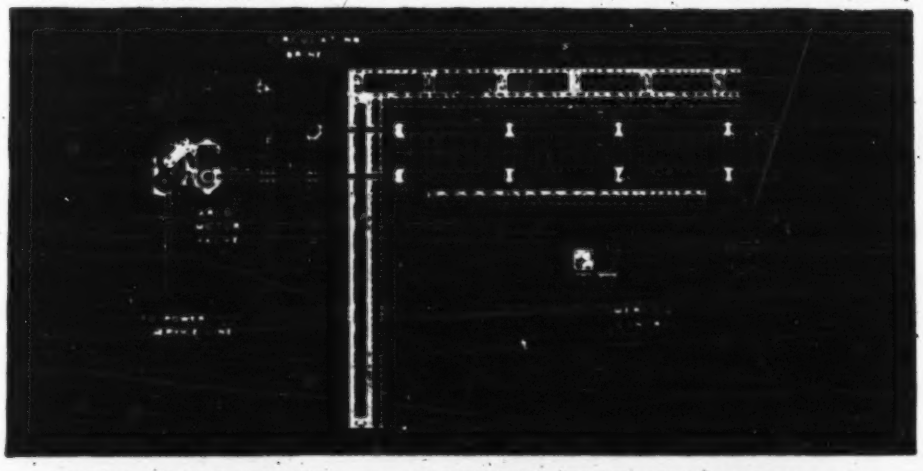
9. Cadmium plated outlet box with removable cover.

10. Connection to apparatus or tube outlet for remote control.

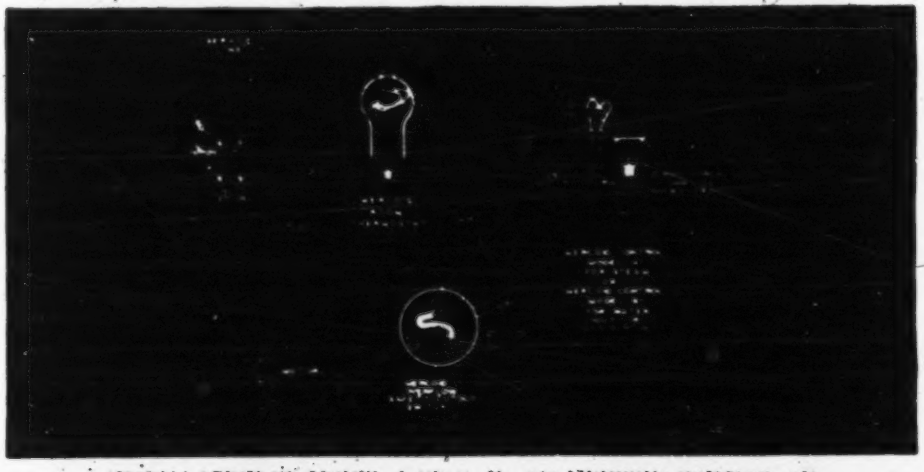
11. Power element seamless all metal bellows.

TWO CIRCUIT No. 848 MERCOID CONTROL. HINGED GLASS FACE REMOVED.

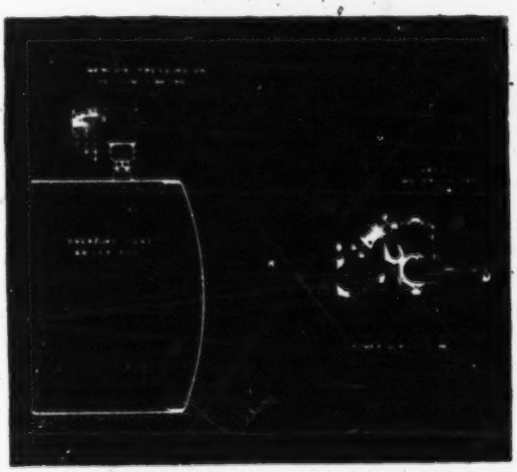
## A FEW APPLICATIONS OF MERCOID CONTROLS



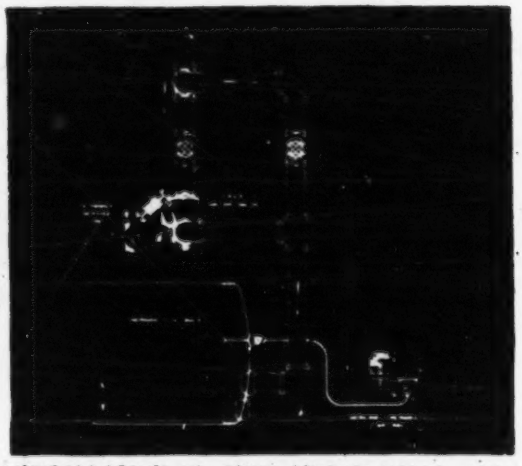
INSTALLATION OF MODEL S. No. 848 MERCOID TEMPERATURE CONTROL IN REFRIGERATING ROOM SHOWING BRINE CONTROL WITH MOTOR VALVE. SIMILARLY MERCOID CONTROL WITHOUT MOTOR VALVE CAN BE CONNECTED TO START AND STOP MOTOR OF REFRIGERATING APPARATUS



INSTALLATION OF MODEL A OR G No. 848 MERCOID CONTROL ON HEATING BOILER WITH OIL BURNING EQUIPMENT



ARCO MOTOR VALVE AND MERCOID CONTROL TO OPERATE A VALVE ACCORDING TO PRESSURE OR VACUUM



INSTALLATION OF ARCO MOTOR VALVE AND MERCOID TEMPERATURE CONTROL FOR LIQUIDS HEATED BY STEAM

Defendant's Exhibit E 521

# AUTOMATIC CONTROLS FOR DOMESTIC AND INDUSTRIAL HEATING EQUIPMENT

# MERCOID

CATALOG
No. H5
1929
REVISED EDITION

The Federal Glass Company
Arden Contact Company

THE MERCOID CORPORATION
564 WEST ADAMS STREET
Chicago, Illinois, U.S.A.

25 CHURCH STREET
New York, N. Y.

1129 FOLSOM STREET
San Francisco, Calif.

Cable Address "MERCOID" Chicago

MERCOID System of DIRECT CONTROL

THE MERCOID CORPORATION

# Mercoid Combination Controls

***For Low Water and Pressure***

AVAILABLE FOR PRESSURES TO 300 LBS.

PATENTS ISSUED
1471130, 1709874, 1640869, 1644935, 1658013, 1721638
OTHERS PEND.

THE Mercoid Low Water and Pressure Control is designed, primarily, for the protection of automatically-fired steam boilers, but has various other fields of application. Boilers to which fuel is supplied continuously offer the hazard of firing into dry boilers or building up excess pressure, against which this instrument is designed to guard.

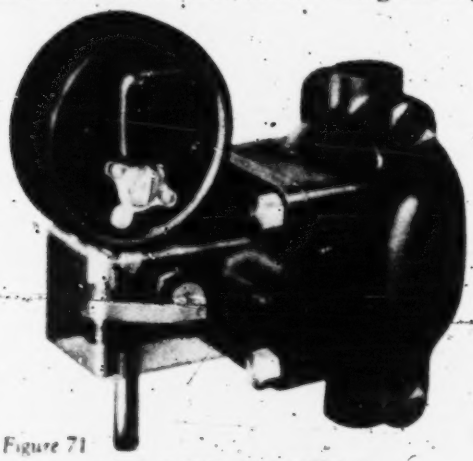
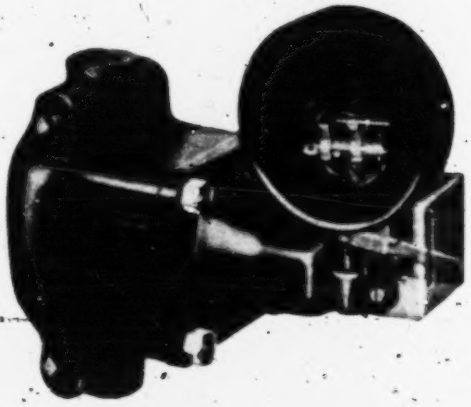


Figure 71

## MERCOID FIGURE 71

*For Complete Protection*

For use on boilers for pressures up to 300 lbs. Arranged to break burner motor circuit when water level falls or when steam pressure rises to a predetermined point. Regularly supplied fully automatic, but made semi-automatic with manual-reset when so specified.



## MERCOID FIGURE 72

*Low Water Control*

Mercoid low water control only, for use on boilers for pressures up to 300 lbs. Regularly supplied fully automatic, but made semi-automatic with manual reset when so specified.

Where used for control of motor-driven feed pump, may be arranged to close circuit at low water level.

Available for pressures above 300 lbs., at special prices.

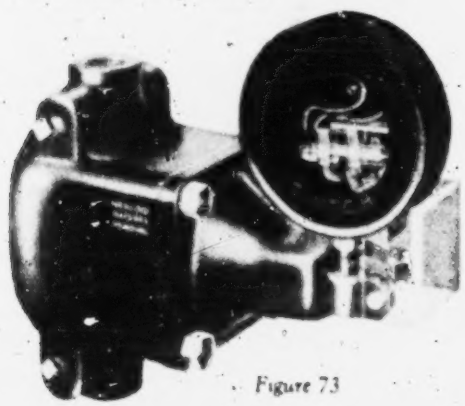


Figure 73

## MERCOID FIGURE 73

*For Vapor or Vapor-Vacuum*

The Figure 73 control has been designed for use where diaphragm regulators are available on the boiler, also for vapor or vapor-vacuum systems having standard equipment floats or diaphragms. Where this unit is attached to such installations, positive operation is assured, especially where very close pressure regulation is essential.

MERCOID System of DIRECT CONTROL

THE MERCOID CORPORATION

# Mercoid Furnace Controls

*A New Design in Furnace Controls Employing a Thermostatic Metal Coil*

*For Warm Air Furnaces and Booster Fans*

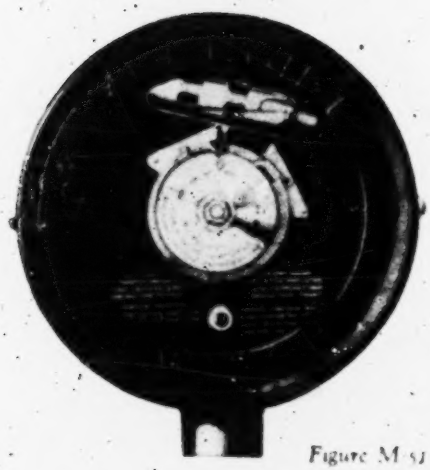


Figure M 51

Figure M 51
Showing side view of instrument

This control is used to prevent the overheating of warm-air furnaces. Used also for booster fan control, to turn on fan when the furnace temperature has reached a predetermined degree shut off when the furnace has cooled to a predetermined temperature. This instrument has some exclusive features. It indicates the temperature in the furnace duct so that one may see at a glance what heat the furnace is generating. This information is useful in determining the amount of heat required for any desired conditions.

The case has a glass front, permitting the temperature dial to be plainly visible.

An adjustable differential is provided.

This control is easy to install, accurate and positive in its operation, and will give long and reliable service.

When ordering specify if it is to be used as a safety furnace control or for booster fan application. The same control can be used for either purpose by simply reversing the Mercoid tube. For furnace control, the mercury switch is placed so that the contacts or electrodes in the switch are to the left side, while for booster fan installation the Mercoid switch is placed with the electrodes to the right side.

The switch tube is shellaced to the clamp at the factory, and if an outside change is made it should again be shellaced so that it will remain in a fixed position.

No relay or starting switch is necessary, when the normal working loads do not exceed 10 amperes at 110 volts or 5 amperes at 220 volts A. C. or D. C.

Dimensions: 16½" long over all, diameter of case 4¼"
Shipping weight 4 lbs. 7 oz.

Standard Range 50 to 60°

LIST PRICES

| | |
|---|---|
| Figure M 51 furnace control single pole | $18.00 |
| Figure M 51 furnace control two pole or two circuit add to list | 6.00 |

MERCOID System of DIRECT CONTROL

THE MERCOID CORPORATION

# Mercoid Furnace Controls

*For Warm Air Furnaces*

A POSITIVE SAFETY DEVICE TO PREVENT OVERHEATING

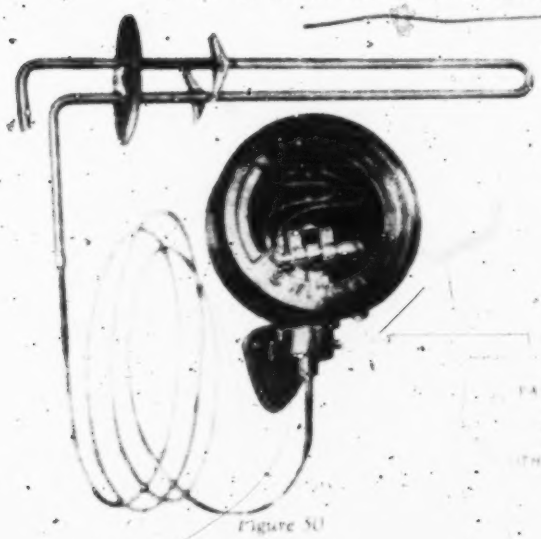


*Figure 50*

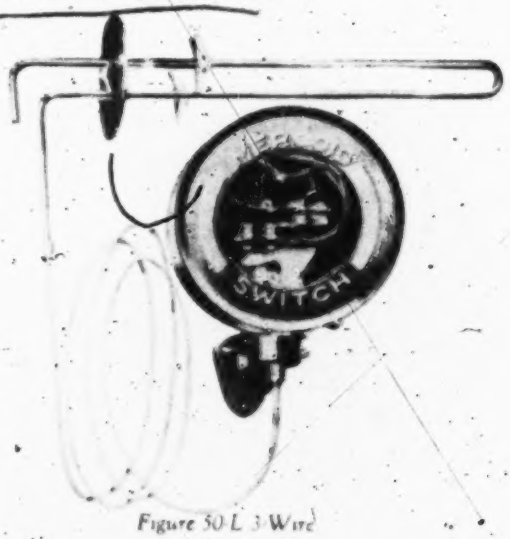



*Figure 50 L 3-Wire*

FIGURE 50

Will handle currents up to 10 amperes at 110 volts or 5 amperes at 220 volts, A. C. or D. C.

FIGURE 50-A

Equipped with Fig. 17 Mercoid Tube. For applications where the current requirements do not exceed 3 amperes at 110 volts, A.C. or D.C.

FIGURE 50-L (3 Wire)

Designed for 3-Wire or low voltage installations. Furnished with one each, red, white and blue binding posts. Will handle currents not in excess of 1 ampere at 110 volts, A. C. or D. C.

THE instruments shown above are designed for operation on warm air furnaces. The bronze remote stem, charged with an expansive liquid, is intended for installation in the furnace-hood above the dome, while the instrument proper may be mounted conveniently on a wall, by means of the bracket provided therefor, as shown in the illustration. Where so installed this control operates as a positive safety device to prevent over heating. Standard range 250° F. to 300° F., opening the electric circuit at the high point and restoring it on a 50° drop in temperature in the furnace dome. The range may be adjusted by simply sliding the stem in or out of the furnace hood, also by the standard adjustment on the back of the case. Regularly furnished fully automatic, may be furnished semi automatic with hand reset, where specified.

Orders should specify whether circuit is to close on rise or fall in temperature.

As a furnace fan control, for automatic control of booster fans on warm air furnaces, the standard range is 100° F. to 140° F., cutting in at high point to start the fan motor and cutting out when the dome temperature drops to the low point.

LIST PRICES

| Fig. 50, $27.00 | Fig. 50A, $24.00 | Fig. 50L, $27.00 |
|---|---|---|
| For 2 Pole or two circuit add to list | | 6.00 |

*Shipping Weight 6 lbs. 11 oz.*

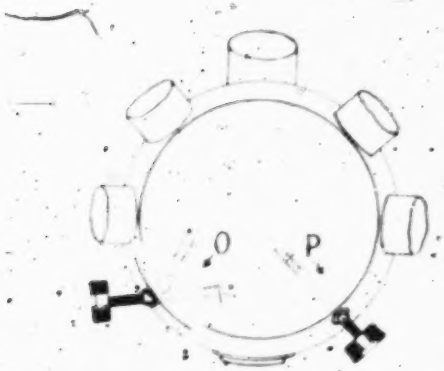
Defendant's Exhibit F

M-51
M-52
M-53

Bulletin S-83

# Mercoid Furnace Controls

*A Positive Safety Device to Prevent Overheating of Warm Air Furnaces*




MERCOID
System of
DIRECT CONTROL

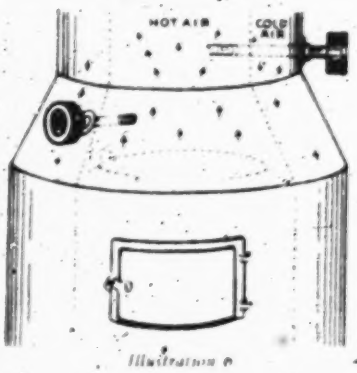



*Illustration 6*

### INSULATION

Since all adjustments are made within the case, ample protection has been provided against accidental contact with live parts or terminals.

### TEMPERATURE DIAL

The dial, located in the center of the instrument, is calibrated from 50 to 650 degrees Fahrenheit, in conformance with the physical characteristics of the bimetallic element.

The average furnace temperature range adjustments are likely to be set somewhere between the 200 and 400 degree marks.

### FLANGES

There are two types of flanges which will enable the installer to place the instrument in almost any required position on the furnace.

The "P" furnace type regularly supplied has a distinctive adjustment feature which enables the installer to place the instrument on the bonnet of a furnace where the angle is 45 degrees or less. At a 45 degree angle the instrument will project at a proper level with a radius directly from the center, as shown in "P" illustration 5, or "K" illustration 7. If the angle is less than 45 degrees the correct operating position may still be maintained by turning the flange until the instrument is horizontal.

In this case the instrument will not have a direct radius from the center but will tend either to one side or the other, as shown in "O", illustration 5. Where the instrument is placed somewhat on the side of a vertical section of the furnace and it is desired to have the face of the control toward the front, this is accomplished by turning the opening of the flange toward the front, as indicated in "L", illustration 7.

The stack type, furnished only when specified, is suitable for duct installation as shown in "M", illustration 7, or on an upright section of a furnace as shown on right side of pipeless furnace, illustration 6.

Both flanges are made of steel and may be reshaped to fit different contours without any danger of breaking.

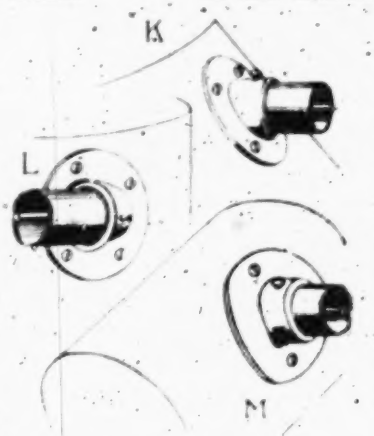



*Illustration 7*

### FIGURE M-52

This control is supplied as a two circuit device for use with three wire systems wherein one circuit is required to be made and the other broken simultaneously.

### FIGURE M-53

This control is arranged to make the circuit when the temperature rises and is identical with the M-51 with the exception that the Mercoid switch is reversed. Usually used in connection with booster furnace fan applications.

Shipping weight 4 lbs. 7 oz. Size of instrument 16½" long overall. Diameter of case 4¾".

### PRICE LIST

| | Single Pole | Double Pole |
|---|---|---|
| *Single Circuit* | | |
| M-51 & M-51A — 10 amperes 110 volts — 5 amperes 220 volts A. C. or D. C. | $18.00 | $24.00 |
| M-51V & M-51AV — 5 amperes 110 volts — 2½ amperes 220 volts A. C. or D. C. | 16.00 | 18.00 |
| *Two Circuit* | | |
| M-52 — 10 amperes 110 volts — 5 amperes 220 volts A. C. or D. C. | $24.00 | |
| M-52V — 5 amperes 110 volts — 2½ amperes 220 volts A. C. or D. C. | 18.00 | |

# Mercoid Furnace Controls

*A New Design in Warm Air Furnace Controls Employing a Thermostatic Metal Coil*

Figure M-51

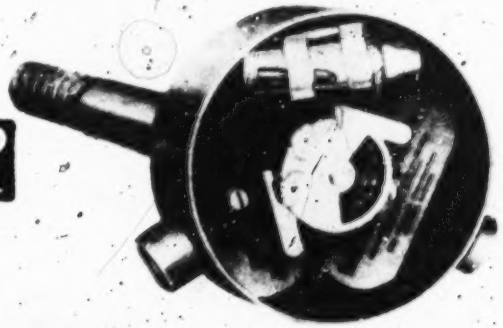



Figure M-51 (Side cover removed)

Side View of Figure No. 51

**FIGURE M-51**

The M-51 Mercoid Furnace Control has been designed primarily to prevent the overheating of warm air furnaces in connection with automatic fuel burning systems.

It is of unique construction and provides a positive and complete means of furnace control at a moderate price.

*DOUBLE ADJUSTMENT FEATURE*

This instrument has the advantage of a simple double adjustment for both high and low operating temperatures to meet the variety of conditions encountered in warm air furnace installations.

The double adjustment mechanism, located within the case of the instrument and readily visible through the glass front, is easily accessible to the installer yet not subject to accidental disarrangement or casual tampering by unqualified persons. Being a limiting device, designed to guard against excessive temperatures which might cause fire hazards or damage to the furnace itself, it is important that after once correctly set that its adjustment be maintained.

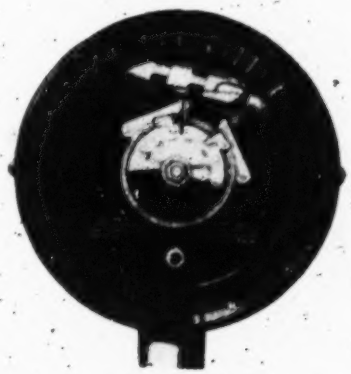


Figure M-51

The fluctuations in furnace temperatures, whether great or small, rapid or slow, are all met by means of this double adjustment feature. What these fluctuations actually are may be determined by means of the temperature indicator in the control.

*DUCT TEMPERATURE INDICATOR*

The duct temperature indicator, located over the dial, also serves the purpose of a switch tilting arm.

While the accuracy of the temperature indication will vary within certain limits, depending upon the adjustment of the control itself, it is sufficiently accurate for ordinary purposes to enable the service man to check the proper size of fire. In this respect its usefulness is comparable to that of the thermometer on a hot water boiler or the pressure gauge on a steam plant.

*BIMETALLIC ELEMENT*

The Mercoid Furnace Control is actuated by a single bimetallic element and is designed so that it both controls the switch and indicates the temperature. A novel construction permits the bimetallic element to maintain its natural course after the switch has been thrown to "off" or "on" position.

*MERCOID SWITCH*

The Mercoid switch used in the M-51 control is of the latest improved type. It has the tipless tube and protected leads. Its construction throughout provides greater efficiency in "make and break" contact. It will operate indefinitely without deterioration

# Installation Instructions

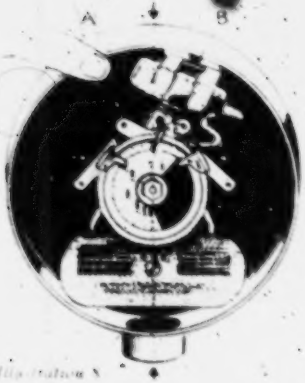



*Illustration 8*

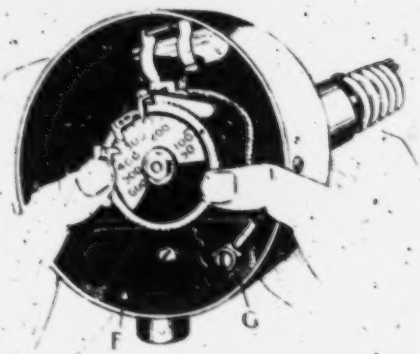



*Illustration 9*

All instruments should be handled carefully. After removing all packing material note tag warning not to twist the bimetallic element. To do so might distort the metal and disarrange the adjustment which was correctly made at the factory.

Care should be given in selection of proper location for both appearance and operation. Do not locate bimetallic element closer than three inches from the dome.

After proper location has been determined, cut a 1¼" hole in the furnace with a rotary hack-saw. Place flange over hole and see that it is perfectly level. This may be done by twisting flange until the proper level has been obtained. Then mark and drill the holes for fastening and attach bolts. Before bolting be sure that the stem when inserted will be perfectly horizontal in position.

If the angular surface of the furnace is less than 45 degrees the instrument will face a little to the right or left and may be placed to the side most desirable, see "O" illustration 5. After the flange has been fastened and the stem properly inserted it is important that the case of the instrument be plumb or vertical in position. This may be determined by separating the high and low adjustable pointers, "C" and "D" illustration 8, far enough apart so they will hold the switch kicking plates away from the switch tripping arm "I". The switch must move freely from left to right without interference of the kicking plates. If the switch remains to the right or left after tilting with the finger, the instrument is ready to be fastened by tightening set screw on flange.

Connect wires next. Remove insulating plate indicated as "E" in illustration 9 by removing screw located in center of plate. After wires are connected to terminal posts, one of which is shown in drawing as, "G" fasten plate back in position.

Then adjust instrument to the desired operating point. While the majority of warm air installations are set at approximately 250 to 900 degrees there are many installations in which this particular adjustment might be insufficient or excessive; therefore a careful study of each case must be made. Bear in mind that the same results of operation can be obtained by locating the bimetallic element farther away from the dome and adjusting it to operate at a lower range. When setting the cut-in and cut-out points, hold the ratchet wheel firmly with one hand while pressing and moving either the high or low pointer, see illustration 9. When pressing pointers see that the catch between the teeth of the ratchet wheel is disengaged, as shown in "I", illustration 10. When releasing the pressure be certain that the catch is again engaged, as shown in "J".

At no time should the instrument be subjected to more than 650 degrees Fahrenheit.

The instrument leaves the factory with the bimetallic element properly heat-treated, formed, stabilized and calibrated. Should the temperature reading be in error due to someone's twisting the bimetallic element, if not excessively twisted it may be readjusted by allowing the instrument to reach room temperature; loosening the nut in the center of dial and moving dial until correct reading is obtained, after which the nut should be tightened.

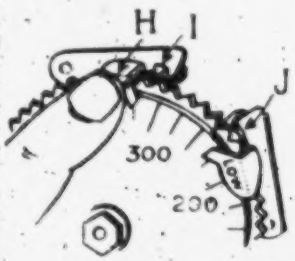



*Illustration 10*

Any manual twisting or bending of the element may permanently distort it. Not only will this destroy the correct calibration of the instrument but also the accurate performance after adjustment is made. It is recommended in case of a badly distorted bimetallic element that the instrument be either sent back to the factory for recalibration or a new bimetallic element ordered for replacement. In ordering element for replacement the serial number of the instrument should be supplied.

THE MERCOID CORPORATION

4201 W. PT. ADAMS STREET, Chicago, Illinois, U. S. A.

Cable Address, Mercoid, Chicago

529

Defendant's Exhibit G-1

# MERCOID
## System of
## DIRECT CONTROL

# COMPLETE AUTOMATIC CONTROLS *for* HEATING EQUIPMENT


THE FEDERAL GAUGE COMPANY

564 WEST ADAMS STREET

*Chicago, Illinois, U.S.A.*

25 CHURCH STREET
*New York City*

THE MONADNOCK
*San Francisco, Calif.*

Cable Address "FEDERATED, CHICAGO"

Copyright 1927
THE FEDERAL GAUGE CO.
Chicago, Illinois

Trade Mark
Registered

# MERCOID SYSTEM *of* DIRECT CONTROL

## Mercoid Furnace Controls

THE instruments shown on this page are giving to the heating trade direct automatic control of motor driven units on warm air furnaces; operating as positive safety devices to prevent overheating.

The standard range for dual control on motor driven units is from 250° F. to 300° F. The range may be adjusted by simply sliding the stem in or out of the furnace hood above the dome, or by standard adjustment on the back of the instrument. Adjustable up to 300° F. to 350° F. or down to 200° F. to 250° F.

The standard range for control of furnace fan on Booster installations is from 190° F. to 140° F., cutting in at the high point to start the fan motor, and cutting out when the temperature drops to the low point.

Furnished with bronze stem, charged with an expansive liquid that insures definite "on" and "off" points without deterioration.

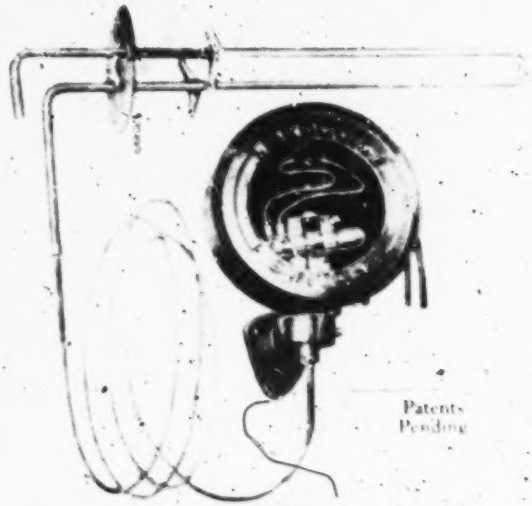



FIGURE 80

Equipped with Figure 3 Mercoid tube for control of motor driven units not exceeding 10 amperes at 110 volts or 5 amperes at 220 volts.

Made in 5¾" diameter case with semi glass front and steel ring; black enamel finish.

Snap action movement is locked in position at both the "on" and "off" points, being actuated by specially designed bourdon tubing of great strength and elasticity.

All these instruments are equipped with a bracket for fastening on the wall.

Made semi-automatic when specified.

In ordering, specify if circuit is to close on rise or decline in temperature.

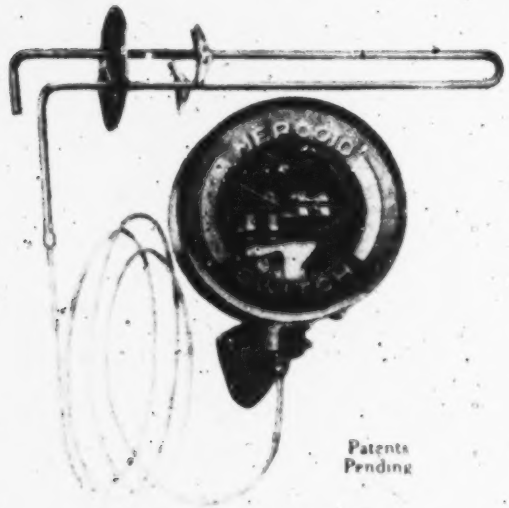



FIGURE 80-L 3-WIRE

Is designed especially for 3-wire or low voltage installations with red white and blue binding posts. Will handle currents not in excess of 1 ampere at 110 volts.

### LIST PRICES

| | Figure 80 | Figure 80-L |
|---|---|---|
| | $27.00 | $27.00 |
| For 2 Pole add to list | 6.00 | |

Shipping weight 6 lbs. 14 oz.

**Defendant's Exhibit H**

# AUTOMATIC CONTROLS FOR DOMESTIC AND INDUSTRIAL HEATING EQUIPMENT

# MERCOID

USED THE WORLD OVER

MERCOID

CATALOG

No H5

1930

REVISED EDITION

Combined Industries:
The Federal Gauge Company
Ardeco Contact Company


THE MERCOID CORPORATION

564 WEST ADAMS STREET

*Chicago, Illinois, U.S.A.*

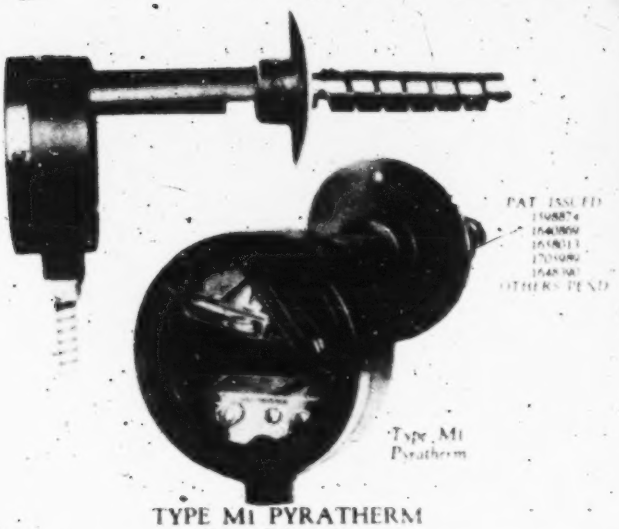
25 CHURCH STREET
*New York, N.Y.*

1129 FOLSOM STREET
*San Francisco, Calif.*

Cable Address "MERCOID" Chicago

# Mercoid Pyratherm

***Stack Safety Controls for Domestic and Industrial Oil Burners***




Type M1 Pyratherm

## TYPE M1 PYRATHERM

(Without Adjustatherm)

Type M1 Pyratherm is a thermostatic bi-metal stack safety control which acts as a shunt where used with a safety cut-out such as the Adjustatherm. (See next page.)

It has a gravity locking mechanism as described on page 13. Another safety feature employed in Type M1 Pyratherm is the Mercoid Figure 9-27 tube which is so designed that the instrument must be mounted in a vertical position to operate. If placed in any other position the circuit is opened, causing the burner to shut down until the position is corrected.

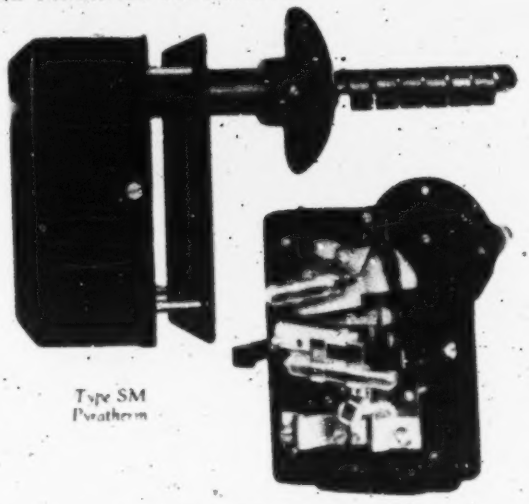
The stamped metal stack flange is strong and light. It will not break if it should be necessary to shape it to a different contour than the one in which it is supplied. The holes are so arranged that the flange may be placed in either horizontal or vertical position and permit the bolts to be placed above and below.

The conduit or BX is brought in at the bottom, so that no paraffine or other insulating material from the wire can be melted and run down on the operating parts.

A glass front is used, making it easy to inspect operation. Solid front covers furnished when specified.

The Mercoid Pyratherm M1 is used with any of the following instruments:

Type SDE (Adjustatherm and Electric Ignition Control).
Type SDP (Adjustatherm and Pressure Ignition Control).
Type SDEG (Adjustatherm and Gas Ignition Control).



Type SM Pyratherm

## TYPE SM PYRATHERM

(With Adjustatherm)

Used on burners having either constant ignition or constant gas pilot, or where the ignition control is a separate feature.

Mercoid Pyratherm Type SM is a complete stack safety control, combining two instruments in one. Type M Pyratherm Stack Safety Control and Type S Adjustatherm Safety Cutout. Designed for flue installation, providing protection against flame or ignition failure.

The Pyratherm is the upper or shunt movement while the Adjustatherm or Safety Cutout is the lower movement. In starting position, the switch on Pyratherm is open, and switch on Adjustatherm closed. The flame heats the thermostatic coil which closes circuit in Pyratherm switch and permits burner to operate continuously. Should there be a flame failure, the thermostatic coil would keep the Pyratherm switch open. In that event the current would be forced through a heating element in the Adjustatherm which would open switch on Adjustatherm and shut down the burner. In this manner the combined use of these controls automatically permits the burner to run continuously only while there is a flame in the furnace.

The Pyratherm movement is the same gravity locking mechanism employed in type M1 Pyratherm as described on page 13. The instrument has the same flange as type M1. The case is oblong and closed throughout. Finished with black heat resisting enamel.

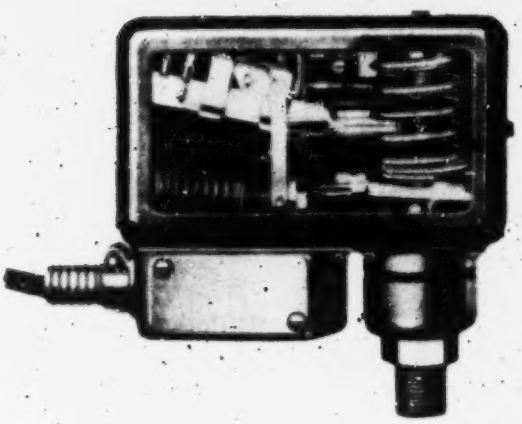
### LIST PRICES

| | |
|---|---|
| Type M1 Pyratherm without Adjustatherm. (See Page 15 for combination list) | $15.00 |
| Size 12" long over all. Depth to flange 7". Diameter of case 4¾". Shipping Weight 4 lbs. 13 oz. | |
| Type SM Pyratherm with Adjustatherm | 30.00 |
| Type SM Pyratherm with Adjustatherm including alarm circuit | 33.00 |
| Size 12½" long overall. Depth to flange 7½". Case 6¼" x 4" x 2¾". Shipping Weight 6 lbs. 11 oz. | |

# Double Adjustment Mercoid Controls

*Type 848*

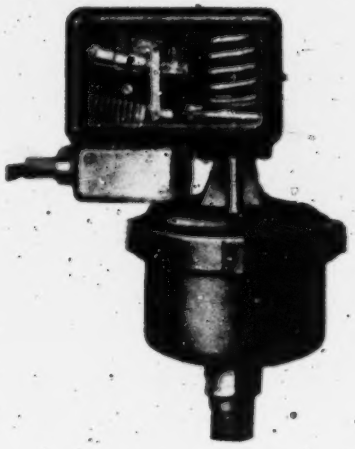
Models A and B



½" Male and ¼" Female Connection

PAT. ISSUED
1948974
1948969
1948911
OTHERS PEND.

Models C and D



1" Male Connection

## FOR PRESSURE AND VACUUM

*(Models A to D Inclusive)*

THE controls shown on this and the following pages are recommended for conditions where it is desired to maintain a close operating differential over a wide range with double adjustment feature for regulating the cut in and cut out points.

The circuit is controlled *directly* to the motor or other electric equipment. No relays, transformers, or other intermediate controls are required for normal working loads of 10 amperes at 110 volts or 5 amperes at 220 volts, A. C. or D. C. As pilot switches where used in series with the proper starting switches Mercoids will automatically control motors of the largest size.

Models A and B are designed for pressure control of steam, air, gas and water. They are widely used for boiler controls in connection with oil burners and forced draft coal burning equipment.

Models C and D are designed for vapor, low pressure or vacuum where very close control is required. Model C is widely used as a boiler control on vapor systems and Model D gives a similarly close regulation on vacuum.

ADJUSTABLE RANGES AND DIFFERENTIALS

| Model | C | D |
|---|---|---|
| Adjustable Operating Range | [illegible] | [illegible] |
| Minimum and Maximum Differential obtained at any operating pressure | [illegible] | [illegible] |

Differential shown indicates pressure difference between operation at high and operation at low [illegible] Model C with range [illegible] Pounds (Inches).

ADJUSTABLE RANGES AND DIFFERENTIALS
MODELS A AND B

| Model | A1 | A2 | A3 | B1 | B2 | B3 | B4 |
|---|---|---|---|---|---|---|---|
| Adjustable Operating Range | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| Minimum and Maximum Differential obtained at any operating pressure | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |

Differential shown indicates pressure difference between operation at high and operation at low.

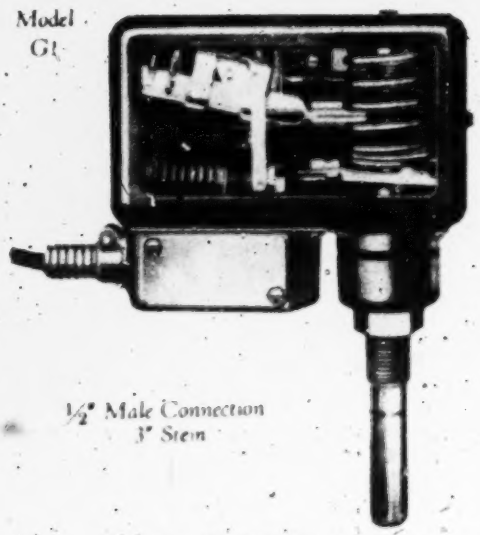
When ordering controls for operation above 15 lbs. please specify if they are to be used on steam as a syphon will then be necessary.

PATENTED

# Double Adjustment Mercoid Controls

*Type 848 (Cont'd)*

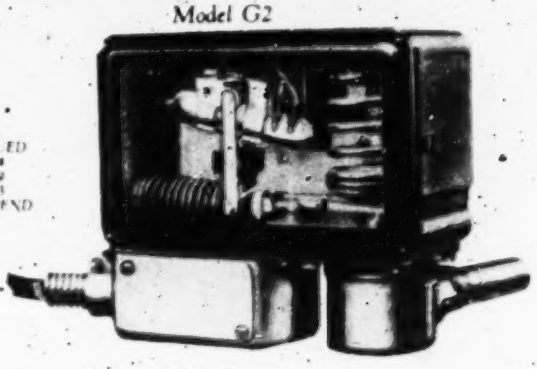
Model G1



½" Male Connection
3" Stem

Model G2

PAT. ISSUED
1908774
1940866
1958013
OTHERS PEND



½" Male Connection
3" Stem

## FOR TEMPERATURE

*(Models G1 and G2)*

DOUBLE adjustment type. For temperature control of hot water boilers and storage tanks. Models G-1 and G-2 are widely used on hot water boiler controls in connection with oil burners and forced draft coal burning equipment.

These types have many applications in industrial work where direct connected instruments can be used. The wide ranges available, combined with the adjustable operating differential, will meet practically every requirement.

ADJUSTABLE RANGES AND DIFFERENTIALS
MODELS G1 AND G2

| Model | Adjustable Operating Range | Approximate Differentials | | | | | |
|---|---|---|---|---|---|---|---|
| | | Minimum when operating point set at | | | Maximum when operating point set at | | |
| | | Low | Med | High | Low | Med | High |
| G1, G2 | 20° to 180°<br>*110° to 220° | 10°<br>10° | 8°<br>11½° | 12½°<br>3° | 46°<br>48° | 40°<br>42° | 24°<br>24° |

*Standard Range

## LIST PRICES

| Model | Single Circuit | Two Circuit Double Pole | Shipping Weight |
|---|---|---|---|
| A1 | $29.00 | $35.00 | 4 lbs. |
| A2-A3 | 32.00 | 38.00 | 4 lbs. |
| B1-B2-B3 | 32.00 | 38.00 | 4 lbs. |
| B4 | 38.00 | 44.00 | 4 lbs. |
| C | 38.00 | 44.00 | 12 lbs. |
| D | 90.00 | 96.00 | 12 lbs. |
| G1 | 32.00 | 38.00 | 5 lbs. |
| G2 | 34.00 | 40.00 | 5 lbs. |

For special ranges add $4.00 to above lists.

Case dimensions of all models 6" wide, 3½" high by 2½" deep.

Shipping weights: Models A and B, 6 lbs. 7 oz.; C and D, 14 lbs. 7 oz.; G1, 6 lbs. 7 oz. and Model G2, 8 lbs. 10 oz.

# Mercoid Furnace Controls

## *A New Design in Furnace Controls Employing a Thermostatic Metal Coil For Warm Air Furnaces and Booster Fans*

Figure M-51

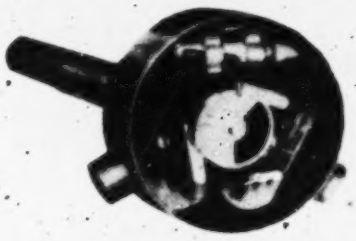


Figure M-52

*The use of this instrument for fan control is fully protected by patent reissue No. 15,531.*

Figure M-53

These instruments are of unique construction and provide a positive and complete means of furnace control at a moderate price.

Mercoid Furnace Controls have the advantage of a simple, double adjustment for both high and low operating temperatures to meet the variety of conditions encountered in warm air furnace installations.

All adjustments are located within the case of the instrument and are not subject to accidental disarrangement or casual tampering by unqualified persons.

Side View

Ample protection has been provided against accidental contact with live parts or terminals.

Another distinctive feature is the duct temperature indicator which shows the temperature in the furnace hood or duct. It enables the service man to check the proper size of fire. The dial is calibrated from 50 to 650 degrees Fahrenheit.

The Mercoid switch used in these controls is of the latest improved type. It has the tipless tube and protected leads. Its construction throughout provides greater efficiency in "make" and "break" contact. It will operate indefinitely without deterioration.

### FLANGES

There are two types of flanges which will enable the installer to place the instrument in almost any required position on the furnace.

The furnace type regularly supplied has a distinctive adjustment feature which enables the installer to place the instrument on the hood of a furnace where the angle is 45 degrees or less. At a 45 degree angle the instrument will project at a proper level with a radius directly from the center, as shown in "K" illustration 5. If the angle is less than 45 degrees the correct operating position may still be maintained by turning the flange until the instrument is horizontal.

In this case the instrument will not have a direct radius from the center but will tend either to one side or the other. Where the instrument is placed somewhat on the side of a vertical section of the furnace and it is desired to have the face of the control toward the front, this is accomplished by turning the opening of the flange toward the front, as indicated in "L".

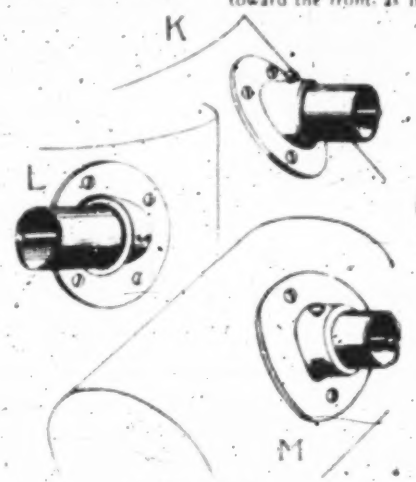



*Illustration 5.*

The stack type, furnished only when specified, is suitable for duct installation as shown in "M", or on an upright section of a furnace.

Both flanges are made of steel and may be reshaped to fit different contours without any danger of breaking.

### FIGURE M-51

The M-51 Mercoid Furnace Control has been designed primarily to prevent the overheating of warm air furnaces in connection with automatic fuel burning systems.

### FIGURE M-52

This control is supplied as a two circuit device for use with three wire systems wherein one circuit is required to be made and the other broken simultaneously.

### FIGURE M-53

This control is arranged to make the circuit when the temperature rises and is identical with the M-51 with the exception that the Mercoid switch is reversed. Usually used in connection with booster furnace fan applications.

### PRICE LIST

| Single Circuit | | | Single Pole | Double Pole |
|---|---|---|---|---|
| M-51 & M-53 | 10 amperes 110 volts | 5 amperes 220 volts A. C. or D. C. | $18.00 | $24.00 |
| M-51A & M-53A | 5 amperes 110 volts | 2½ amperes 220 volt A. C. or D. C. | 16.00 | 18.00 |

TWO CIRCUIT

M-52 10 amperes 110 volts 5 amperes 220 volts A. C. or D. C. $24.00

M-52A 5 amperes 110 volts 2½ amperes 220 volts A. C. or D. C. 18.00

*Shipping weight 4 lbs. 7 oz. Size of instrument 16½" long overall. Diameter of case 6¼"*

# Mercoid Furnace Controls

*For Warm Air Furnaces*

A POSITIVE SAFETY DEVICE TO PREVENT OVERHEATING

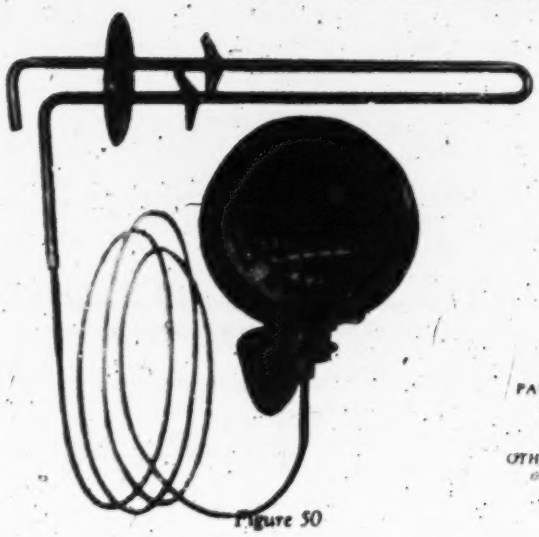


Figure 50

PAT. ISSUED
1521638
1906874
1640886
1618013
OTHERS PEND.

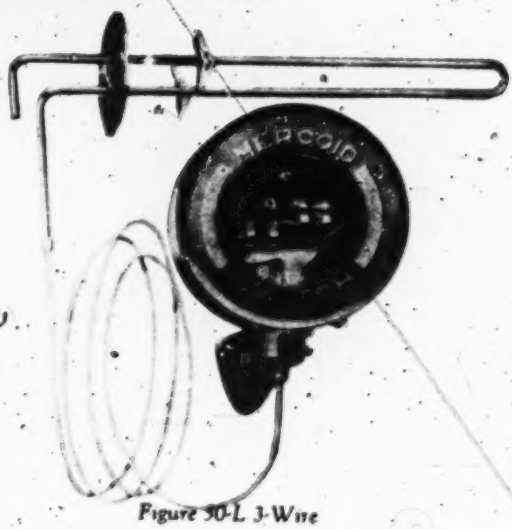



Figure 50-L 3-Wire

FIGURE 50

Will handle currents up to 10 amperes at 110 volts or 5 amperes at 220 volts, A. C., or D. C.

FIGURE 50-A

Equipped with Fig. 17 Mercoid Tube. For applications where the current requirements do not exceed 3 amperes at 110 volts, A.C. or D.C.

FIGURE 50-L (3 Wire)

Designed for 3-Wire or low voltage installations Furnished with one each, red, white and blue binding posts. Will handle currents not in excess of 1 ampere at 110 volts, A. C. or D. C.

THE instruments shown above are designed for operation on warm air furnaces. The bronze remote stem, charged with an expansive liquid, is intended for installation in the furnace hood above the dome, while the instrument proper may be mounted conveniently on a wall, by means of the bracket provided therefor, as shown in the illustration. Where so installed this control operates as a positive safety device to prevent over-heating. Standard range 250° F. to 300° F., opening the electric circuit at the high point and restoring it on a 50° drop in temperature in the furnace dome. The range may be adjusted by simply sliding the stem in or out of the furnace hood, also by the standard adjustment on the back of the case. Regularly furnished fully automatic; may be furnished semi-automatic, with hand reset, where specified.

Orders should specify whether circuit is to close on rise or fall in temperature.

As a furnace fan control, for automatic control of booster fans on warm air furnaces, the standard range is 190° F. to 140° F., cutting in at high point to start the fan motor and cutting out when the dome temperature drops to the low point.

LIST PRICES:

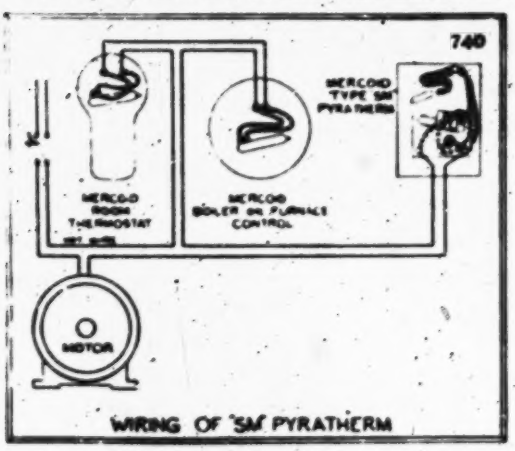
Fig. 50, $27.00 Fig. 50A, $24.00 Fig. 50L, $27.00

For 2 Pole or two circuit add to list 6.00

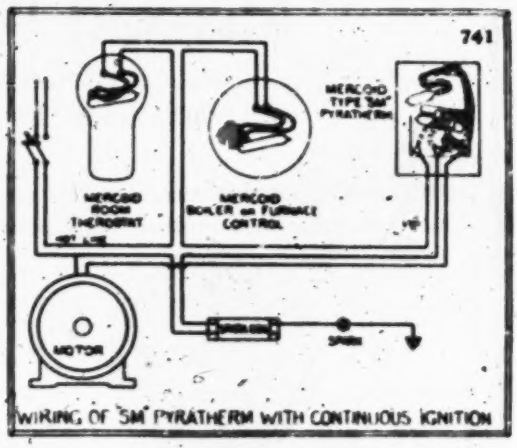
*Shipping Weight 6 lbs. 11 oz.*

# 538 TYPICAL MERCOID WIRING DIAGRAMS

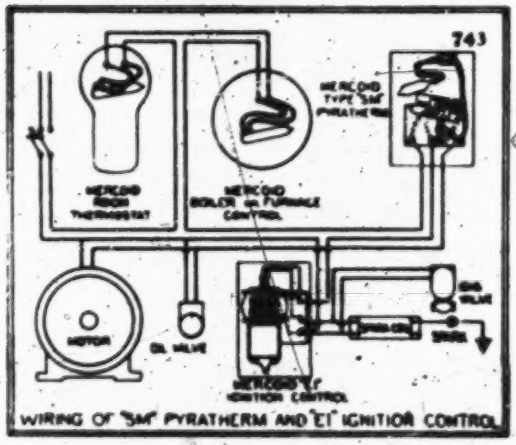
THE simplicity of the Mercoid system of 2-wire direct control is fully recognized. There are no confusing or intricate wiring installations to be made. The hazards and expense of improper hookup are avoided.



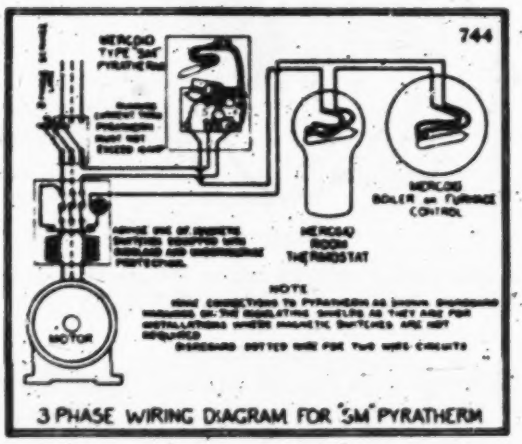
WIRING OF 'SM' PYRATHERM



WIRING OF 'SM' PYRATHERM WITH CONTINUOUS IGNITION

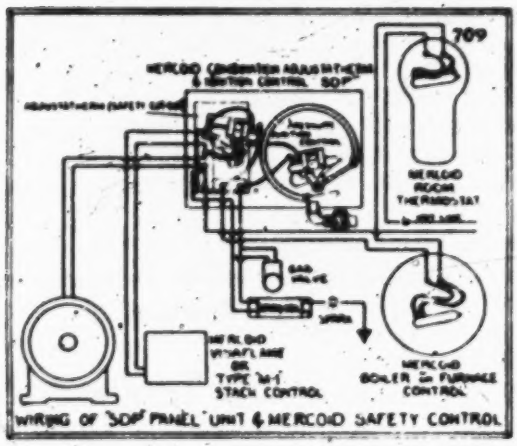


WIRING OF 'SM' PYRATHERM AND 'S' IGNITION CONTROL

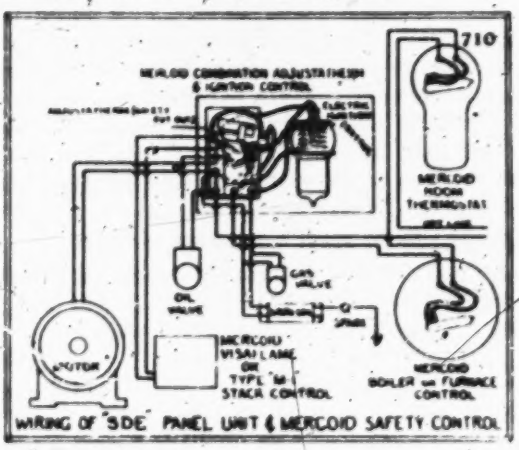


3 PHASE WIRING DIAGRAM FOR 'SM' PYRATHERM

The hookups shown above are typical of the usual oil burner installations in connection with the Pyratherm Type SM



WIRING OF 'SDP' PANEL UNIT & MERCOID SAFETY CONTROL

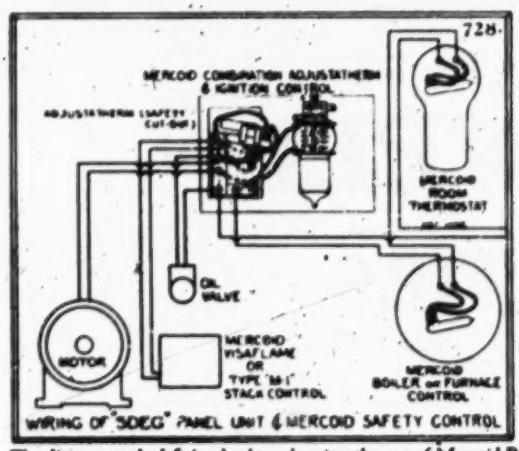


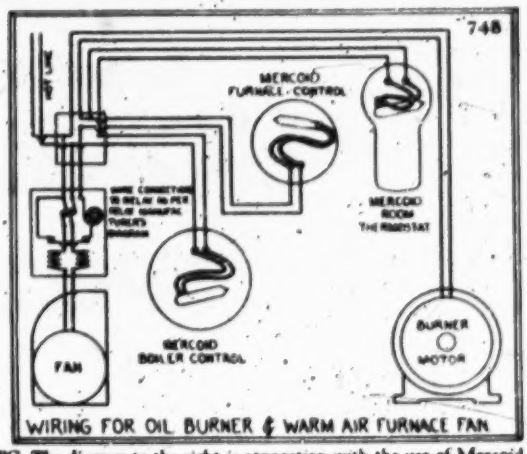
WIRING OF 'SDE' PANEL UNIT & MERCOID SAFETY CONTROL

The hookups shown above are typical of the usual oil burner installations in connection with Mercoid Panel units SDP and SDE.

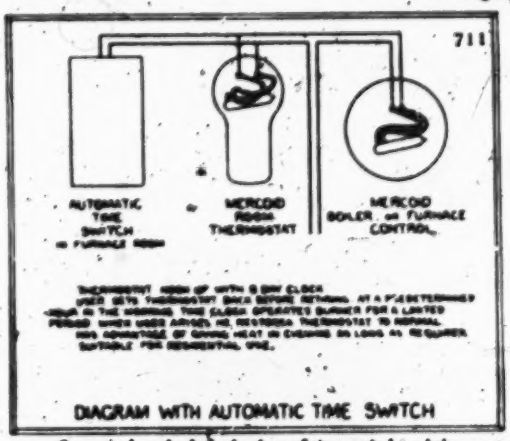
# TYPICAL MERCOID WIRING DIAGRAMS

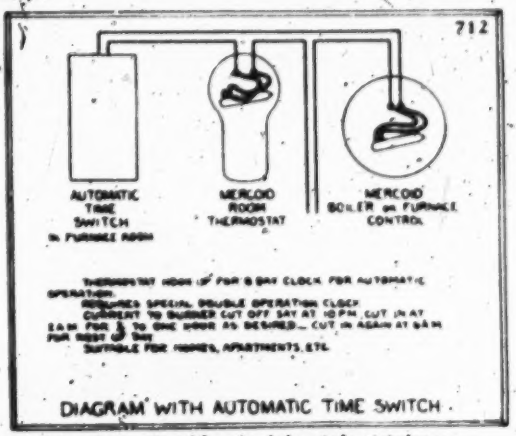
THE simplicity of the Mercoid system of 2-wire direct control is fully recognized. There are no confusing or intricate wiring installations to be made. The hazards and expense of improper hookup are avoided.



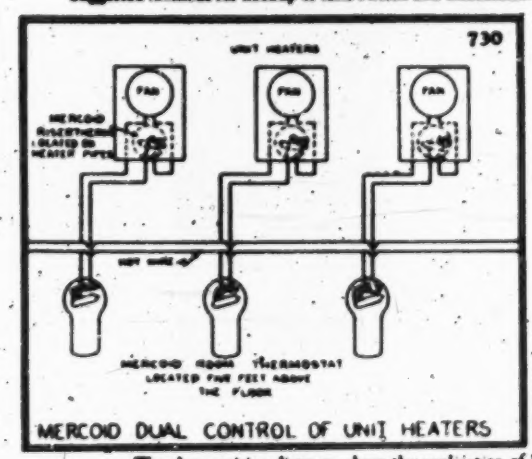



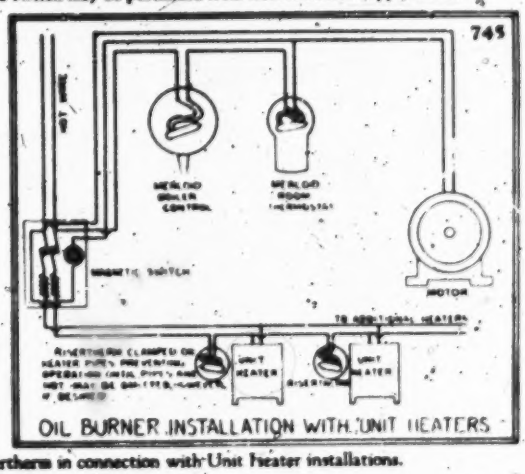

The diagram to the left is a hookup showing the use of Mercoid Panel Unit SDBG. The diagram to the right is connection with the use of Mercoid Figure M-51 and Figure 30.




Suggested methods for hookup of time switch and thermostat. Standard time switch may be purchased from local electrical supply house.




The above wiring diagrams show the application of Mercoid Risertherm in connection with Unit heater installations.

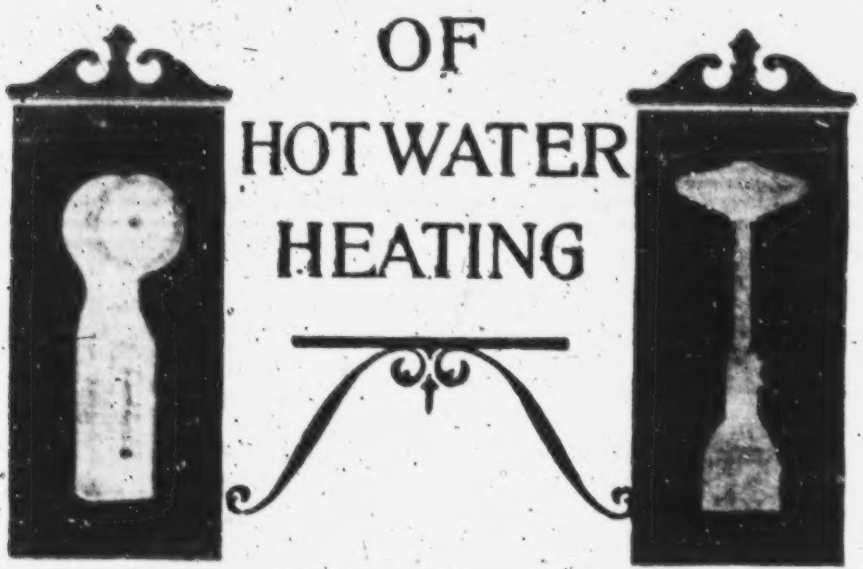
Defendant's Exhibit I-1

# HONEYWELL

## SPECIALTIES

AND

## THE HONEYWELL SYSTEM OF HOT WATER HEATING



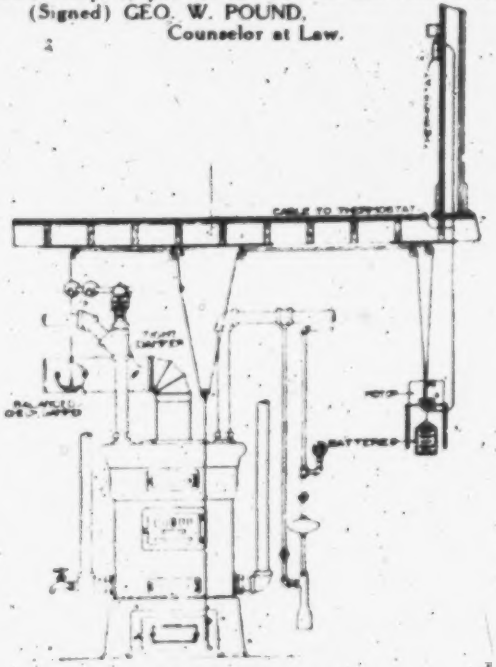
HONEYWELL

Buffalo, N. Y., Dec. 24, 1915.

Honeywell Heating Specialties Co.
Wabash, Ind.

Gentlemen:—I installed in my residence one of your Temperature Regulators in connection with the heating plant and wish to express to you the great service and kindness that you have done to me and mine by letting me know of this very practical and sensible device. I have no trouble now in regulating the temperature of my home, have no worry as to whether I forget to open or close the check or damper, and, in fact, am wholly relieved from all trouble of the heating plant, except to provide it with coal and remove ashes.

(Signed) GEO. W. POUND,
Counselor at Law.



## Hot Water

How any model Honeywell Temperature Regulator can be connected to a hot water heating plant. Where No. 3 Water Regulator is used, connect same as steam installation.



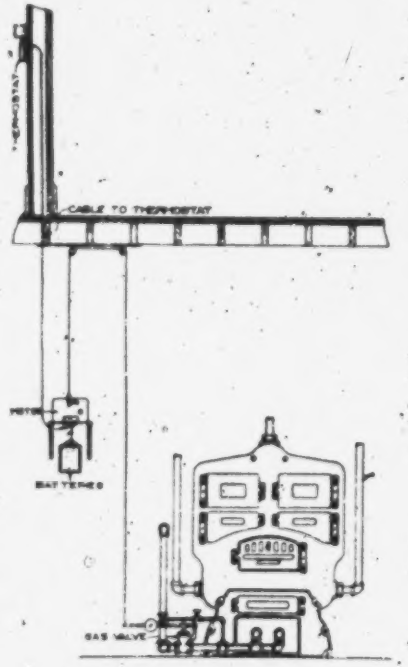
HONEYWELL

Milwaukee, Wis., Dec. 20, 1915.

Honeywell Heating Specialties Co.,
Wabash, Ind.

Gentlemen:—The Model 8 clock which you recently repaired for me arrived in good condition and I thank you for your courteous treatment. I also wish to add that the regulator is entirely satisfactory and I consider it as good an investment as I ever made.

Yours truly,
(Signed) H. T. ERICKSON,
453 24th Ave.



## Gas as Fuel

How any model Honeywell Temperature Regulator can be installed to operate gas valve.

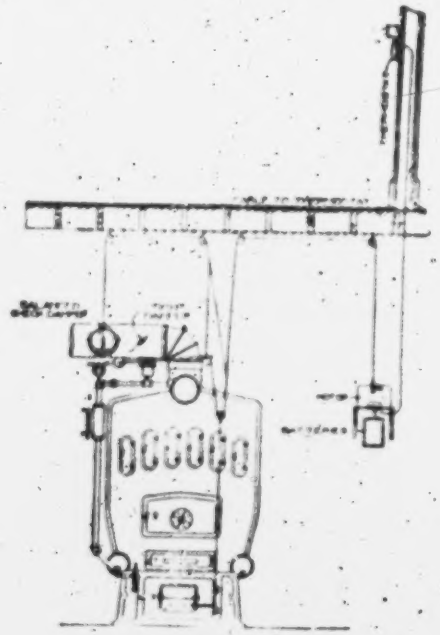
HONEYWELL

Jersey City Heights, N. J., Jan. 15, 1920.

Honeywell Heating Specialties Co.,
Wabash, Ind.

Gentlemen:—I have one of your Honeywell Room Temperature Regulators installed in my home and like it so well that I wish you would send your literature to my son-in-law. If you have a representative in Montclair, New Jersey, please give him your representative's name and address.

Very truly yours,
U. ALLEN, M. D.



## Steam or Vapor

How any model Honeywell Temperature Regulator can be installed in connection with the diaphragm regulator on steam or vapor boiler.



HONEYWELL

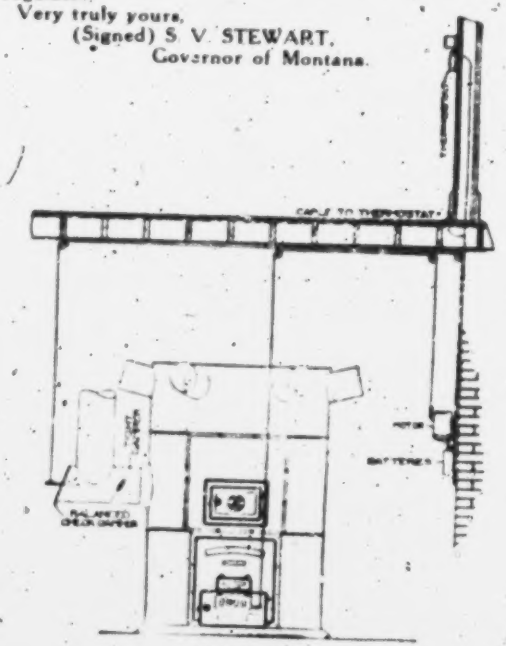
Helena, Mont., Jan. 8, 1916.

The Honeywell Heating Specialties Co.,
Wabash, Ind.

Gentlemen:—Referring to the Honeywell Temperature Regulator placed in the Executive Mansion by Mr. R. D. Stocking, I have to report that the regulator works with perfect accuracy. We find it to be thoroughly up to the representations made. It does the work for which it was designed to our entire satisfaction. Since the installation of the regulator we have had no trouble with run-away fires, whereas before it was hard to keep the house at an even temperature. We were apt to either have it too hot or too cold.

I am glad to advise you of the results obtained by the installation of the regulator.

Very truly yours,
(Signed) S. V. STEWART,
Governor of Montana.



## Hot Air

How any model Honeywell Temperature Regulator can be connected to hot air furnace.

**Defendant's Exhibit I-2**

# HONEYWELL
## Heating Specialties

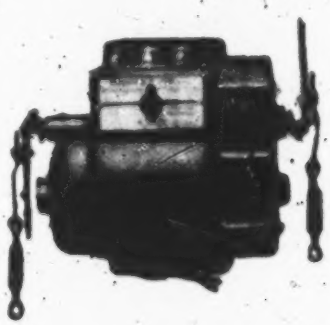
# Electric Motor

THE new Honeywell Electric Regulator Motor is unquestionably one of the greatest achievements of recent years in the small electric motor field.

Line voltage is taken into the motor and without a transformer a low voltage current is available for the thermostat circuit that will not injure the most delicate contacts through years of use. This Honeywell Electric principle can be utilized only in Honeywell Electric Motors. Developed by our electrical and mechanical engineers, together with the engineers of the General Electric Company, all features are fully covered by patent applications.

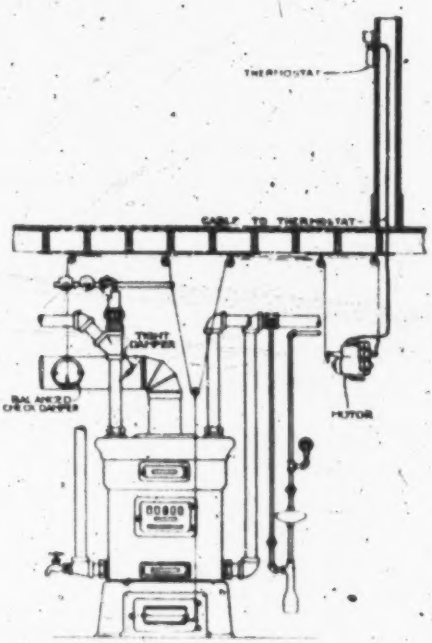
Eight years were required to develop this motor to its present degree of perfection. Motors in test, without attention of any kind, have made as many operations as would be required to control the average heating plant for more than one hundred years.

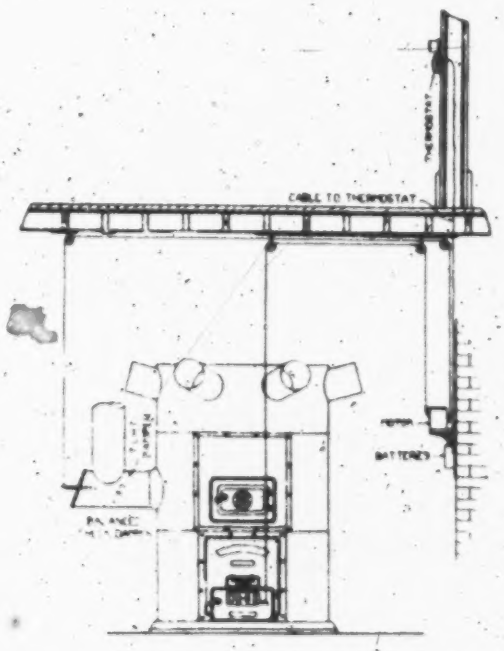
Designed for use with any one of the Honeywell Thermostats, this motor opens or closes heaviest dampers when used in connection with the burning of coal, or operates various kinds of valves, including oil, water, steam and gas, day in and day out, without attention of any kind.



# Regulator Installations

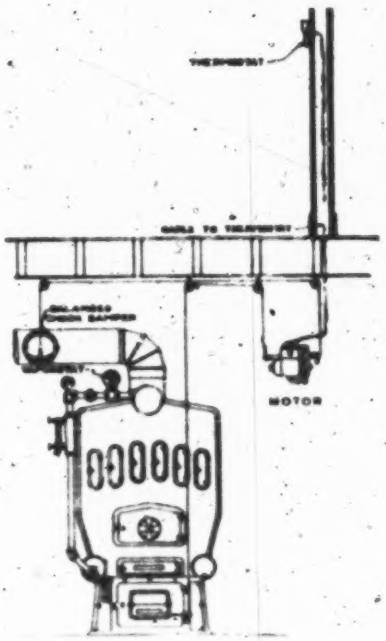
Hot Water Boiler with Thermostat, Electric Motor, Heat Generator and Hot Water Valve.



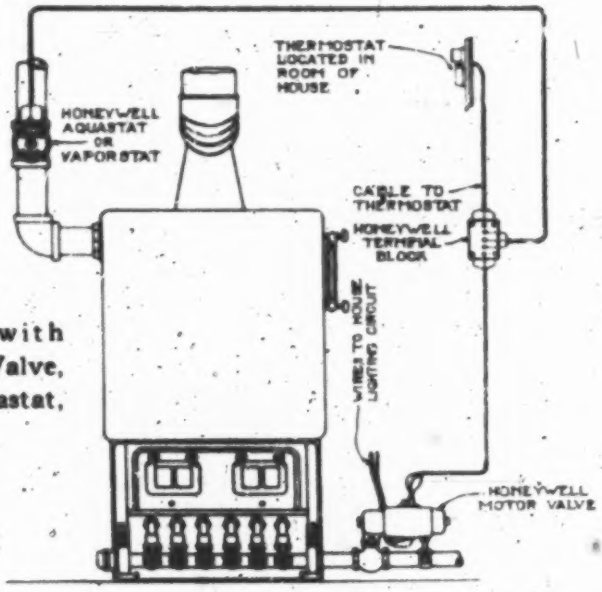




Warm Air Furnace with Thermostat and Spring Motor.

# Regulator Installations




Steam Boiler with Thermostat, Electric Motor and Vaporstat.




Gas Boiler with Honeywell Motor Valve, Thermostat, Aquastat, or Vaporstat.

# Aquastat

THE Honeywell Aquastat is designed to be used in connection with any style Honeywell motor, for controlling the temperature of hot water plants, bake ovens, dryers, vulcanizers, etc.; also used in connection with Room Temperature Regulators for limiting the temperature of water heating systems. The instrument will operate on the temperature of either air or liquids at temperatures ranging up to 300 degrees.

The Aquastat is very neat and compact, the dial being only 4 inches in diameter. The bulb extends approximately 1¾ inches beyond the threaded portion, which screws into a ¾" iron pipe opening. This instrument is easily attached to existing plants.

The Aquastat is furnished regularly for operation on temperature of liquids. For operation on air temperatures the instrument is furnished with perforated bulbs of special lengths at a slight additional charge. These special instruments are sometimes required where the body of the instrument is to remain outside of a dry room for ease of adjustment and where the bulb is to extend through the wall into the dry room. Prices of special instruments are quoted upon application.

# Vaporstat

THE Honeywell Type "B" Vaporstat is a snap-acting, non-floating contact pressure regulating device for vapor or steam heating systems.

It can be instantly set to control the pressure at any predetermined point. Where desired, it can be connected to operate in conjunction with Honeywell Room Temperature Regulators, using the Thermostat and Motor already installed.

In the above case, the wiring arrangement is such that the Vaporstat serves as a limiting device by closing the heater dampers, oil or gas valve when the predetermined pressure has been reached. At all other times the Room Thermostat is in complete control.

This new instrument is built regularly to operate on from 10 inches of vacuum to 30 pound pressure, functioning accurately between 10 inches of vacuum and 5 pound pressure. For pressures in excess of 5 pounds, instruments calibrated from 0 to 30 pounds and from 0 to 150 pounds, can be furnished.

These instruments can be easily and quickly set to cut in and out at any points on the scale. By reason of the snap-acting movement the control resides in the Vaporstat, ONLY while the pressure is falling from the predetermined maximum to the predetermined minimum. This is a most important and valuable feature.

The Honeywell Type "A" Vaporstat is still available for those who prefer this type of instrument.

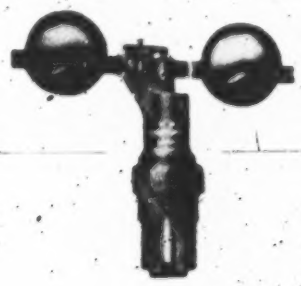
# Water Regulator

THE No. 30 Honeywell Water Regulator is designed for hot water boilers and tank heaters and will control the drafts so as to maintain a constant water temperature at any degree between 100° and 220° Fahr. This saves the inconvenience of attending the drafts, gives the comfort of a steady water temperature and saves heavily in fuel by preventing overheating.

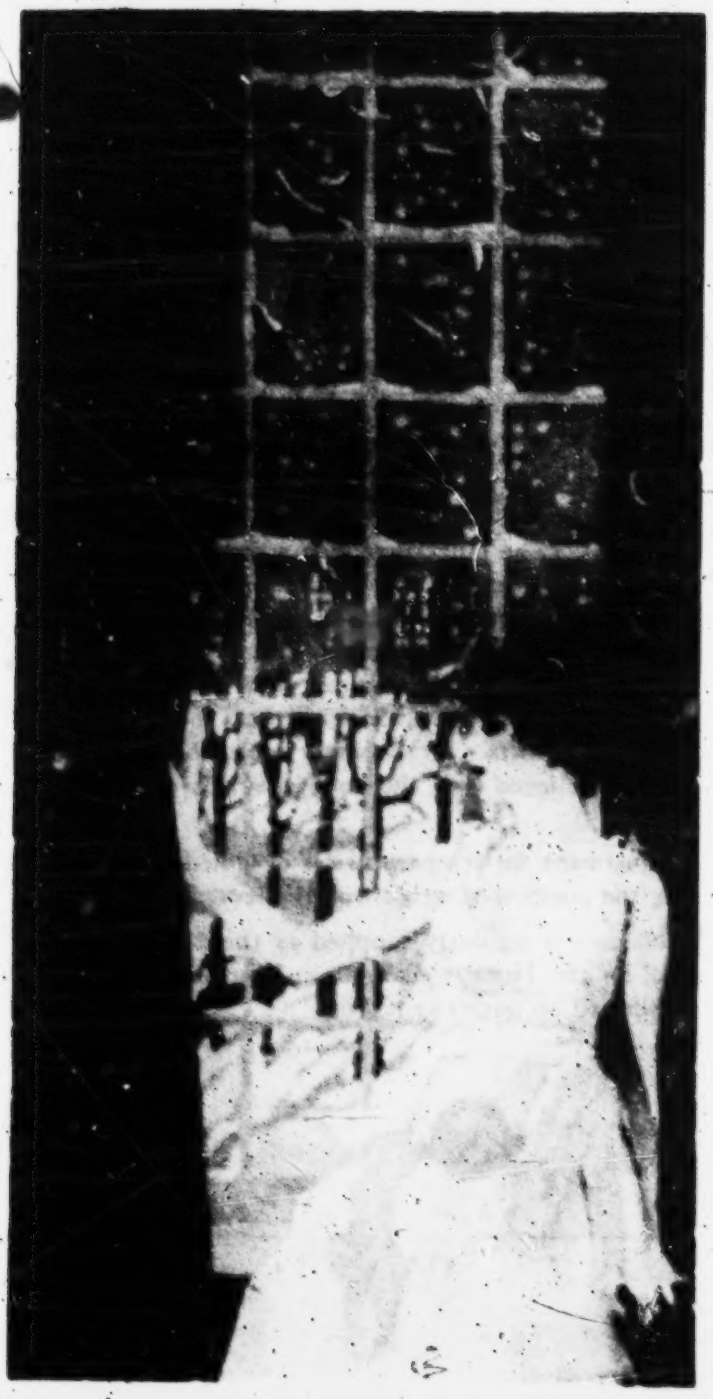
The Honeywell Water Regulator is made entirely of metal. The bulb surrounds a seamless metallic bellows and contains a volatile liquid. As the water temperature in the system increases, the liquid vaporizes. The gas pressure thereby generated compresses the bellows and forces upward the thrust rod or stem which operates the lever and closes the drafts. As the water cools, the gas pressure is relieved and the counterweight opens the draft.

Adjustment for temperature is obtained by changing the position of weights on the lever.

This unit is regularly supplied as the damper control for the Honeywell Tank-in-Basement Method described on page twenty-six.



Defendant's Exhibit I-3



# THE HEART of THE HEATING PLANT

## MINNEAPOLIS HEAT REGULATOR

# Scientific Management of a Heating Plant

OVER thirty years ago a Twin City man found to keep his heating plant at an even and correct temperature required more time and worry than he could afford to give it. Being a typical Yankee, he invented a simple mechanical device to do this work for him.

By connecting the drafts of his furnace with a little motor and this motor with a thermostat in the room above, he found that without any attention on his part, except to set the thermostat for the temperature he desired, the contrivance automatically opened or closed the dampers and always kept his home at the desired temperature.

The mechanism was called a heat regulator.

After the regulator had been installed he was surprised to find how much he saved on his fuel bill by burning just enough and not too much. He found that it relieved him entirely from the fear of fires from overheated pipes and as the years went by he discovered that his heating plant lasted longer than any of his neighbors, because it had not been subjected to extremes of heat and cold.

This was the beginning of the heat regulator business, and today the Minneapolis Heat Regulator, a perfected model developed from this simple beginning, is celebrating its thirty-third birthday.

The Minneapolis Heat Regulator will control equally well hot water, steam, hot air, vapor, vacuum, gas, street steam, street hot water, "combination" heating plants or municipally furnished heat.

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WHAT SIR HUGH MCDONALD THINKS OF THE HEART OF THE HEATING PLANT

*Winnipeg, Canada.*

I have used the Minneapolis Heat Regulator for twelve or fourteen years, and it has given me the utmost satisfaction. My wife tells me that she has not known what comfort was in winter until the regulator was in our home.

Yours truly,

HUGH J. MCDONALD

THE HEART OF THE HEATING PLANT

## Stops the Waste in Your Fuel Bin

UNEVEN temperatures mean fuel wasted. Where no temperature regulation is used, the dampers of the heating plant are opened and often forgotten until the temperature has risen away beyond the 70° mark. Then the windows are thrown open and the house cooled off. The fire has gained a big headway and even after the dampers are closed too much heat is given off. The dampers will then be left closed until some one is too cool and the scene is then re-enacted.

Each time this is done, dollars go up the chimney in wasted heat, which gives you positively no benefit, and in the course of a heating season, the wasted fuel is a big item in your fuel bills.

The Minneapolis Heat Regulator prevents all this. An even fire is run at all times. As soon as the temperature reaches the proper point, the thermostat closes the drafts and when the temperature drops one degree, it opens them again. This means an even, healthful heat with the fire checked except when necessary to keep your home at a comfortable temperature. The Minneapolis Heat Regulator is in control night and day and allows only the minimum amount of coal to be used, no wastage.

This coal saving is so important an item, that the money saved will soon pay for the regulator and then each year yield you big dividends on your investment.

---

SAYS HE USES 20 PER CENT LESS FUEL

Bristol County Savings Bank
Taunton, Mass.

*Aug. 11, 1914*

I purchased a Minneapolis Heat Regulator for this Bank and also one for my residence, and both are exceedingly satisfactory.

We find in the past two seasons that we have saved fully 20 per cent on our expenditure for coal, and ay for keeping an even temperature in our rooms they are simply perfect.

A. C. PLACE, Treasurer

# AUTOMATIC CONTROLS

Defendant's Exhibit I-4

for
OIL BURNERS
1929

TIME-O-STAT CONTROLS COMPANY
ELKHART, IND.

554

# AUTOMATIC CONTROLS FOR OIL BURNERS

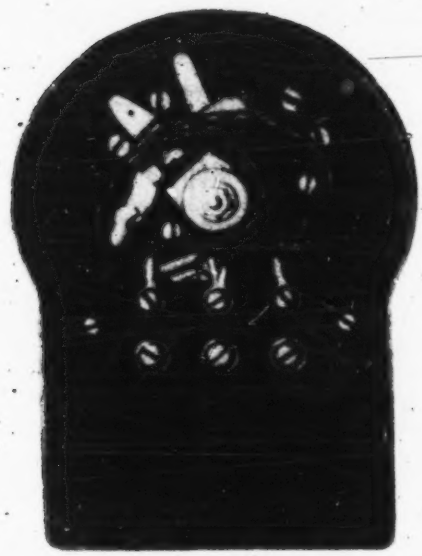
*Also Manufacturers of Automatic Controls for Gas Burners, Coal Burners, Electric Refrigerators, Mechanical Stokers, Furnace Fans, Industrial Ovens, Ice Machines, Unit Heaters, Water Heaters. Also Sign Flashers, Mercury Switches, Electric Heaters, Corrugated Metal Bellows*

**TIME-O-STAT CONTROLS COMPANY**

**ELKHART, INDIANA**

TIME-O-STAT CONTROLS COMPANY
ELKHART, INDIANA

# The Stackswitches



*The No. 48H Stackswitch*

TIME-O-STAT Stackswitches are available in several types of models for various requirements of burner and control operation. Their chief function is that of a monitor device to govern or switch electrical circuits to provide the desired sequence in operation of the burner itself or of other safety or operating controls.

### *Operation in General*

A helix of bimetal extending rearward from the housing of the Stackswitch is inserted in the stack of the boiler or furnace 3 feet or more from the breeching or where the maximum temperature does not exceed 1000° F. So located, the bimetal element will be in the path of the hot gases leaving the combustion chamber. The result of temperature changes arising from the ignition of the oil fire or its extinguishment is the expansion or contraction of the bimetal about the axis of the helix. This in turn imparts to a horizontal shaft upon which the Mercury Switches are mounted, the movement necessary to tilt the Con-Tac-Tors to "off" or "on" position.

### *Used with No. 77 Lockswitch System*

The No. 48H Stackswitch is primarily designed for operation only with the No. 77 Lockswitch System. This Stackswitch is equipped with two single pole Con-Tac-Tor Mercury Switches so arranged that as the temperature rises, one circuit is broken and a second circuit is completed. Each Con-Tac-Tor Mercury Switch operates from a separate friction element and is so arranged that the switching action of each may be separately governed.

The curved Con-Tac-Tor Mercury Switch of the 48H Stackswitch is closed when the Stackswitch is in the cold position and open when the Stackswitch is in the hot position. It thus governs the ignition and pull coil circuits, or the starting cycle of the Lockswitch. A timed shut down following a loss of flame in the burner is controlled by this Con-Tac-Tor. The straight Con-Tac-Tor Mercury Switch, closing on temperature rise, governs the hold coil circuit in the Lockswitch, maintaining the motor switch tube and armature in the closed position. The curved Con-Tac-Tor Mercury Switch may be swung through a considerably greater arc due to moveable stop pins which limit its travel.

Ignition timing is possible by adjustment of the left hand stop pin of the No. 48 Stackswitch, a longer timing being available when the curved Con-Tac-Tor moves to a greater angle to reach its hot position. Adjustment of the right hand stop pin governing the curved Mercury Switch governs the length of the shut-down interval of the Lockswitch System after a flame or voltage failure.

Thus when the curved Con-Tac-Tor Mercury Switch advances through a great angle to reach the right hand stop pin, it also requires a longer time to return to its cold position. Therefore as the standard Mercury Switch is so arranged that it cannot swing through as wide an arc, a return from the hot position opens both circuits in the Stackswitch causing the shut down. The automatic operation of this Stackswitch, however, returns both Mer-

TIME-O-STAT CONTROLS COMPANY
ELKHART, INDIANA

# The Stackswitches

cury Switches to the cold position, assuring automatic recycling of the Lockswitch System and an attempt at a second start without manual attention. Provision is made in the No. 48H Stackswitch for adjustment allowing operation on burners of the high-low fire type.

### *Fast Acting Model*

The No. 48HS Stackswitch is a modification of the 48H Stackswitch and is designed to be used on installations in which the stack temperatures rise and fall slowly and is, therefore, useful in cases in which the 48H Stackswitch action is not fast enough. This Stackswitch model is recommended for two or three pass or fire box boilers in which the fire travel is unusually long. Also on high efficiency oil burning boilers and furnaces where abnormally low stack temperatures prevail.

### *For No. 88 Lockswitch System*

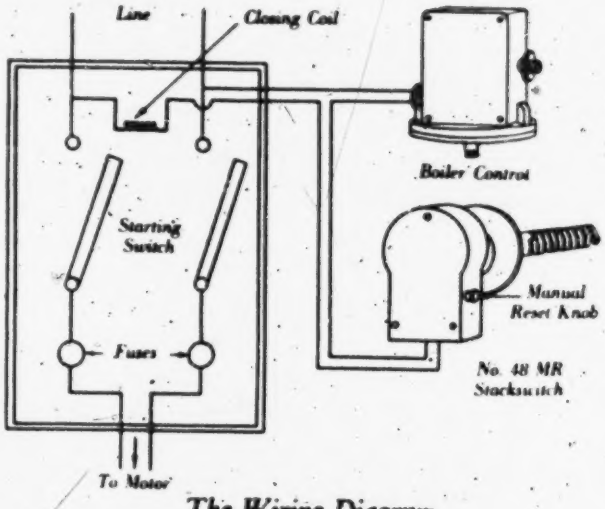
The No. 48HB Stackswitch is to be used only with the No. 88 Low Voltage Lockswitch System. It is similar in action to the No. 48H Stackswitch except that the 48HB Stackswitch employs the use of three Con-Tac-Tor Mercury Switches in order to govern the ignition line circuit separately from the low voltage pull and hold coil circuits.

### *Other Models*

The No. 48 Stackswitch includes one single pole two wire Mercury Switch. It is so placed that it will be turned to its "off" position, thus opening an electrical circuit, on a rise in stack temperature. The No. 48 Stackswitch is usually used to control ignition circuits with either a spark transformer solenoid gas valve or hot wire ignition element. Such operation allows ignition to be continued only until flame is ignited in the boiler or furnace and the stack temperature begins a definite rise. Yet being governed from stack temperatures the ignition must be assured before the ignition means is cut off.

### *Reversed Action Model*

The No. 48R Stackswitch is also equipped with one single pole two wire Mercury Switch,




*The Wiring Diagram*

but the position of this switch is reversed so that electrical circuits are closed on a rise of temperature. Such construction is normally used to by-pass the heating element circuits of safety controls which are included in the starting cycle.

The No. 48R Stackswitch is equally applicable for the closing of any circuit which should be delayed until oil fire is definitely ignited and the stack temperature has begun its rise.

The No. 48C is used where it is desirable to open one circuit and close another as the stack temperature rises. Two single pole Mercury Switches are mounted to a common shaft in the housing of the Stackswitch and arranged to work as a single pole double throw switch.

### *Manual Reset Model*

The No. 48MR Stackswitch is a special adaption of Stackswitch control for the industrial or semi-automatic oil burner installation. This Stackswitch provides a safety for manually ignited burner installations or for those installations operating on high-low fire principle. To accomplish the desired results, this Stackswitch is built on the manual reset principle and requires the pulling of a manual

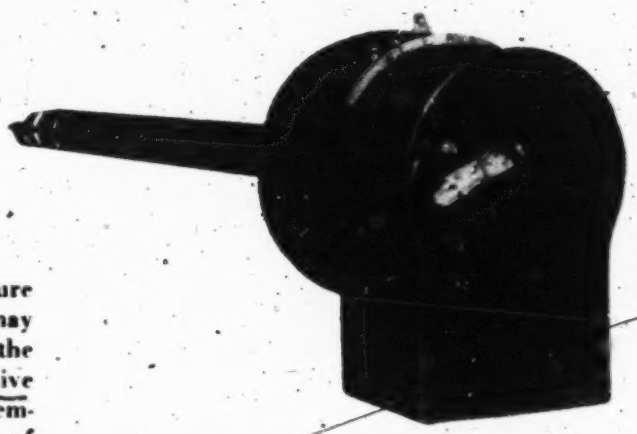
TIME-O-STAT CONTROLS COMPANY
ELKHART, INDIANA

# Warm Air Furnace Limit Controls

### *Application of Various Models*

THE No. 68 Furnaceswitch is recommended as a limit control for use on warm air installations. The No. 68 regulates the operation of the heating equipment by controlling temperatures from the warm air compartments of hot air systems.

By proper adjustment of the temperature setting of the Furnaceswitch, this control may be used either as the operating control of the furnace or as a safety cut-out for excessive temperatures. In the latter case a higher temperature setting is made, and the operation of the furnace is turned over to some other control, such as a room thermostat. The No. 68 Furnaceswitch is a two wire control arranged for line voltage service as a direct control of the heating equipment. The No. 68B is a three wire control and can be used successfully on low voltage circuits.



*The No. 68 Furnaceswitch*

### *The Manual Control Model*

Incorporating the added feature of manual control, Time-O-Stat offers the No. 106 Furnaceswitch. Except for this feature it is identical with the No. 68 Furnaceswitch. The No. 106 has been specially designed as a line voltage cut-out for use with three wire low voltage control systems. This control is so arranged that when a given high temperature as set by pointer is reached, the Mercury Switch opens the main line circuit and shuts down the system. Under these conditions the main line will remain open until the No. 106 is manually reset by pulling on the reset knob at the side of the case. This manual reset feature is of a distinct advantage in that it enables the rest of the control system to be manually recycled to its starting position when necessary before the line voltage is returned.

### *The No. 184 Fanswitch*

The efficiency and satisfaction of a warm air system is often greatly increased by the use of fan blowers or booster systems which aid the circulation of the air through the furnace. This type of blower or booster fan is being widely installed by all classes of the heating industry and the No. 184 Fanswitch has been developed to automatically control the furnace fan. This Fanswitch closes the circuit when the temperature in the warm air bonnet rises. So long as the bonnet is cold the fan is not running, but as soon as the warm air is available the fan is automatically started. The fan continues in operation so long as warm air is available unless by proper connection with a room thermostat both the heating equipment and the fan can be shut down when the room temperature reaches the setting of the thermostat.

TIME-O-STAT CONTROLS COMPANY
ELKHART, INDIANA

# *Warm Air Furnace Limit Controls*

### *No. 73 Ovenswitch*

Designed particularly for industrial use, though of similar construction to the No. 68 Furnaceswitch, Time-O-Stat offers the No. 73 Ovenswitch. This control is primarily arranged for the temperature regulation of industrial ovens. It is installed in the same manner as the Furnaceswitch and maintains a temperature within a total differential of 15°.

### *Furnaceswitch Operation*

It is the expansion and contraction of the bimetal helix, which is inserted in the warm air compartment of the furnace, that causes the rotation of the axis on which the Mercury Switch is mounted. This rotation tilts the Mercury Switch to "on" or "off", making or breaking the circuit with the burner, dependant on the temperature existing in warm air bonnet. In the case of the No. 184 Fanswitch controlling the operation of the fan motor on booster systems, the reverse action takes place. It closes the circuit upon a rise of temperature equal to that of setting on scale, and breaks the circuit when the temperature falls below the setting on the No. 184.

### *Simple Installation*

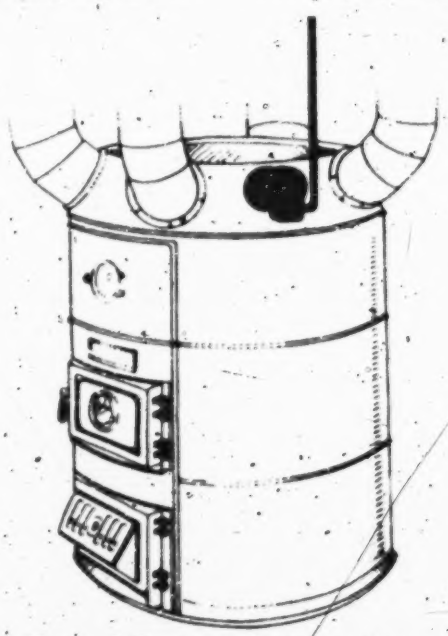
Installation of any model of this type of limit control is easily accomplished. A suitable flange is provided, and after a small hole is cut in the side of the bonnet the flange is then affixed to the bonnet by sheet metal screws. An ingeniously arranged collar and double set screws make it a simple matter to level the instrument regardless of the angle of the slope of the bonnet.

All models of the Furnaceswitch and also the Fanswitch are listed as standard by Underwriters' Laboratories.

### SPECIFICATIONS

No. 68 (2 wire): For line voltage circuits.
Resistance Loads: 15 A. 110 V.; 10 A. 220 V.
Motor Loads: 1 H. P. 100-250 V. A.C., ½ H. P. 100-250 V. D.C.
On D.C. or 25 Cycle A.C. parallel Mercury Switch with an M377 Condenser. See page on Condensers at back of catalog.
No. 68B (3 wire): 4 A. 25 V. For low voltage circuits.
No. 184 (2 wire): Identical with No. 68, except arranged to close circuit on temperature rise.
No. 106 (2 wire): Identical with No. 68, but arranged for manual reset after opening.
Adjustable Range: 100° to 500° F.
Differential: Approximately 65° F.
Height: 5½". Width: 4". Length: 17".
Extension of stem into furnace, 12".
No. 73: Identical with No. 68, except for following:
Differential (Not Adjustable): 15° F.
Height: 6½". Width: 4⅛". Length: 14½".
Shipping Weight: 7 lbs. All Models.

| | |
|---|---|
| *List Price, No. 68, 68B or 184* | *$17.50* |
| *List Price, No. 73* | *$25.00* |
| *List Price, No. 106* | *$18.00* |



*Typical Furnaceswitch Installation*

**Defendant's Exhibit J**

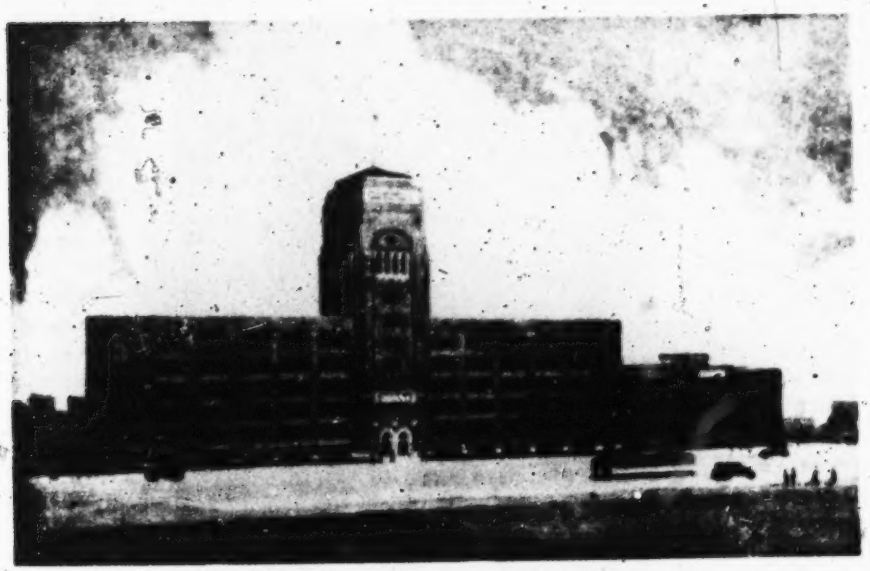
# MINNEAPOLIS-HONEYWELL REGULATOR CO.

EXECUTIVE OFFICES

**MINNEAPOLIS, MINN.**

FACTORIES

**MINNEAPOLIS, MINN.** **WABASH, IND., U. S. A.**



*View of Minneapolis, Minn., Plant*

## BRANCH OFFICES:

| | | |
|---|---|---|
| NEW YORK CITY | CHICAGO | PHILADELPHIA |
| MILWAUKEE | ST. PAUL | CLEVELAND |
| BOSTON | DETROIT | ST. LOUIS |

Mineral Exhibit
J-1

# THE PYROSTAT

IN CASES where the conformation of combustion chamber and of the oil burner do not permit a suitable mounting of the Protectostat it is necessary that some other means of indicating successful ignition be used. The rise in temperature of the flue gases passing up the stack to the chimney has been found to be almost as reliable an indication of successful ignition as the radiant energy from the flame, and the Minneapolis-Honeywell Pyrostat has been developed to operate on this change in the flue gas temperature.

The Pyrostat presents a marked improvement in the stack type of combustion safety control. Electrically it is identical with the Protectostat and it is connected into the circuit of the Protecto-relay just as the Protectostat is. Simplified construction eliminates the necessity for a friction mechanism in order to make or break contact on the first rise or fall in temperature, allowing for the over-travel which is required by the wide variations of stack temperature attained under various atmospheric conditions.

The operation of the Pyrostat is caused by the tendency of the spirally wound bi-metallic strip to unwind with a rise in temperature. The spiral is mounted so as to project into the stack; one end is attached to the body of the Pyrostat and the rotation of the free end as the temperature rises turns a shaft which passes back through the center of the spiral and into the body of the instrument. A toothed gear wheel, or escape wheel, is mounted on this shaft and turns with it.

As the temperature rises the escape wheel turns, carrying with it a phosper bronze spring, which allows two contact points to come together, completing the circuit through the Protecto-relay. As the escape wheel continues to turn with the continued rise in temperature, this spring passes from tooth to tooth without affecting the contact. If the stack temperature drops a predetermined amount, the escape wheel will engage the spring and separate the contact points, breaking the circuit to the Protecto-relay.

## Mounting

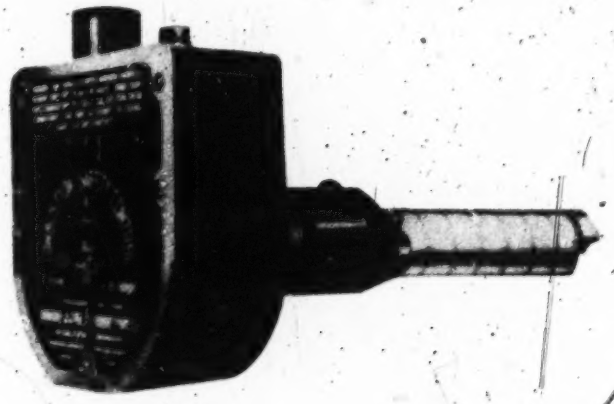
It may easily be seen that due to the type of mechanism used, the position in which the instrument is installed is immaterial and neither vibration nor a change in the position of the instrument can have any effect.

The Pyrostat when incorporated in the Protectorelay circuit provides identically the same sequence of operations as the Protectostat.

# TYPE B COMBUSTION SAFETY CONTROL

THE *Combustion Safety Control is designed to be used with the Type DSS Motor Switch* or Type DSSV Motor Switch Valve—and together they control the safe operation of the burner.

*The actuating element* is a coil of bi-metallic metal, which responds to the changes in temperature—approximately 100° change will cause it to function, and as the instrument is ordinarily installed in the stack this change is brought about in a very few seconds. In the head of the instrument on the end of the shaft to which the thermostatic element is attached are 2 mercury tube type switches. As the bi-metallic element expands or contracts, the high and low volt switches are tilted.



*When the room Thermostat calls for heat* and the Motor Switch enters the starting cycle, no heat passes up the stack if combustion fails to take place. Consequently, the Combustion Safety Control remains in the cold position, leaving the burner motor circuit open in the high voltage tube, so that at the completion of the Motor Switch's ignition cycle, the burner motor stops. This prevents an abnormal discharge of oil.

*If the flame is extinguished* in some manner before the burner motor has been shut off, the drop in stack temperature will cause the element of the Combustion Safety Control to contract and break the circuit to the burner motor. At the same time the circuit to the burner motor is broken, the circuit is established through the low voltage tube of the Combustion Safety Control to the Motor Switch, which will cause it to recycle and give the oil burner one more chance to function correctly. If combustion fails to take place, then the Combustion Safety Control will remain in the cold position and the burner will be locked up.

*If current fails* while the burner is on, the burner motor of course stops, and as the stack cools, the circuit to the Motor Switch is completed in the low voltage tube of the Combustion Safety Control, and is broken in the high voltage tube to the burner motor. When current service is resumed the burner motor will be off, but the Motor Switch will automatically recycle, again starting it.

*To meet Underwriters' requirements*, the electrical circuit between the DSS Motor Switch and the Combustion Safety Control is so arranged that the System will not function when the Combustion Safety Control is disconnected.

Defendant's Exhibit K

# MERCOID

## AUTOMATIC CONTROLS

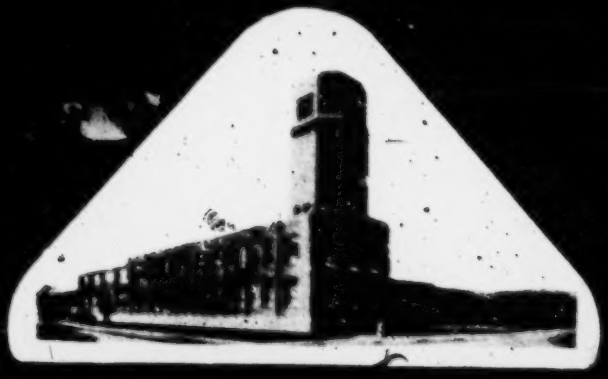
*for*

## STOKERS

*and*

## FORCED DRAFT

COAL BURNING EQUIPMENT



# MERCOID CONTROLS

THE design and construction of Mercoid controls insure ease of installation and satisfactory performance, with freedom from service expense and replacements.

The advantages of the Mercoid 2-wire system of direct control are recognized, as manifested by an ever-increasing demand.

They are made for automatic or semi-automatic direct control of motors where the normal working load does not exceed 10 amperes at 110 volts or 5 amperes at 220 volts, A.C. or D.C. As pilot switches, where used in series with the proper starting switch, Mercoids will automatically control motors of the largest size. No transformers are required for voltages up to 220.

All types of Mercoid controls employ a sealed glass tube switch, containing inert gases and mercury. There are no exposed conducting surfaces, therefore, the possibility of open arcing, oxidation or corrosion is eliminated.

Mercoid switches are actuated by a snap action movement, which locks the switch at both the "on" and "off" points, preventing premature or erratic operation as the result of a jar or mechanical vibration. MERCOID CONTROLS are listed as standard by the Underwriters' Laboratories, Incorporated.

Every Mercoid Control is carefully tested and inspected before leaving the factory, and if properly installed will give years of satisfactory service without further attention. They should be handled with the care which any instrument of close accuracy requires.

Before installing Mercoid Control check the nameplate to be sure that the operating range is suitable for the condition to be met, and then carefully install after fully reading the installation instructions packed with each control.

## ORDERING DATA

### IMPORTANT

Mercoid Controls have many varied applications where equipment other than standard is required. Special controls can be furnished without great delay and at moderate prices. When writing for additional data give full information as to the requirements to be met.

It is important that the following information should appear on all orders to insure shipment of the correct material, and to prevent delay occasioned by writing for additional information.

1. Figure or model number.
2. Kind of control.
3. Temperature or pressure range. Specify range and exact cut-in and cut-out points required.
4. Capacity of switch (10 ampere, 3 ampere, etc.).
5. Whether single circuit, two circuit or double pole.
6. If single circuit or double pole, whether to make or break on rising temperature or pressure.

## REPAIRS AND CREDITS

Repairs in the field are in most cases impractical. We are equipped to give satisfactory service at reasonable cost.

Returns for credit or for exchange must not be made without our consent. Credit allowed will be subject to 10% deduction for handling and inspection, plus a further charge for recalibrating or refinishing, if necessary. Specially made instruments cannot be credited except at what we determine is fair value to us.

All instruments returned must be carefully handled and properly packed for shipment.

# No. 855 MERCOID THERMOSTAT

The automatic regulation of room temperatures is very important in connection with stokers or forced draft coal burning equipment. The No. 855 Mercoid Thermostat is particularly adapted for this type of application, and will give dependable and economical service with an increase of efficiency in the heating system.

In designing this instrument, three things were taken into consideration: greater sensitivity, compactness and neatness.

The unique feature is the projection of the thermal element, which is exposed directly to the atmopshere and is, therefore, most sensitive to air temperature changes.

The encased fluid in the thermal element, as it expands or contracts, actuates the inner bellows which operates the movement by throwing the switch to "on" or "off" position.

Illustration No. 2 shows the thermal element from the rear, detached. A section is removed to illustrate its internal construction. "J" shows the thermal fluid between the outer covering "D" and the inner bellows "I." The post indicated as "K" is fastened to the bellows and actuates the control as the bellows expands or contracts by means of temperature changes.

*Illustration No. 2*

A construction eliminating the ventilating apertures in the cover has long been desired, for it permits greater improvement in the operation and appearance of a thermostat.

While the chief aim was to produce an instrument as nearly perfect in

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OTHERS PENDING

operation as scientific skill and experience were able to attain, its appearance was also given special study.

To meet the requirements of varying surroundings, it was necessary to have a design that would adapt itself to any scheme of decoration, and this has been accomplished in the Mercoid No. 855 Thermostat. It is pleasing in its simple outline and the dull gold finish will look well on any wall.

The 855 Thermostat is equipped with the 9-51 Mercoid tipless tube switch, the latest development in mercury sealed contact switches. Perfect electrical contact is assured indefinitely.

There is no open arcing where Mercoid Controls are used.

The Tycos thermometer, specially designed for the No. 855 Thermostat, greatly enhances its beauty. Placed in an oblique position a departure from usual practice, it may be easily read at a glance. In case of breakage, replacement is simple and convenient, as it is necessary merely to order another thermometer and attach it. Each thermometer is individually graduated to insure accuracy.

The No. 855 will operate directly across the line where the normal current working load does not exceed 10 amperes at 110 volts or 5 amperes at 220 volts.

As a pilot switch where used in series with the proper starting switch, the Mercoid Thermostat will automatically control stoker motors of the largest size.

This instrument may be furnished with a locking device to prevent tampering.

Illustration No. 3 has a section of the thermostat removed to show the locking device "M" in position, which fits around the back of the thermal element "D." The temperature indicator is locked in the slot "O" of the device, "P" shows the key used with lock nuts "L" one to the right is not shown.

*Illustration No. 3*

Each thermostat is carefully tested and all adjustments are made at the factory, assuring correct performance.

Standard Ranges: 56 to 80°, 45 to 72°, and 38 to 60° F. Approximate normal operating differential 1½ degree. Size of instrument: Width, 3¼"; Depth, 1⅜"; Depth over-all including thermal element, 2⅜"; Height, 5".

**LIST PRICES**

Available Only for Single Pole

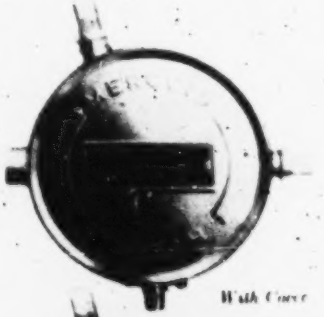
| | |
|---|---|
| No. 855T (with thermometer), with 10 Amp. Fig. 9-51 R Tube | $24.00 |
| No. 855T (with thermometer), with 3 Amp. Fig. 9-61 R Tube | 22.50 |
| If ordered without thermometer, deduct from list | 1.50 |
| For locking device and key, add to above lists | 1.00 |

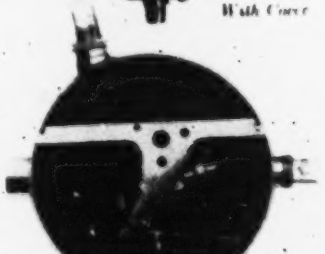
# MERCOID PRESSURE CONTROLS

## FOR VAPOR-VACUUM, LOW AND HIGH PRESSURE STEAM BOILERS

Mercoid pressure controls are widely used in connection with automatic stokers or forced draft coal burning equipment. They are equipped with the Mercoid tipless tube, the latest development in enclosed mercury contact switches. Close and accurate control can be maintained at any pressure required by selecting the proper instrument from the many available ranges.

### No. 858 Model AA-3




*No. 858 Model AA-3*
*Adjustable Range*
*10" Vacuum to 15# Pressure*

The No. 858 Model AA-3 Mercoid control is a double adjustment instrument of simple design and sturdy construction. By means of the external adjustments this instrument can be set to operate at any point from 10 inches vacuum to 15 pounds pressure. The differential or pressure change necessary to operate this control can readily be set from as close as 1 pound to as wide as 6 pounds.

This instrument is particularly adapted to low pressure steam or vapor-vacuum boilers, where it is desirable to change the pressure setting with changes of outdoor temperature. Cadmium plated throughout to prevent corrosion. Threaded connection, ¼-inch male I.P.S.

### No. 848 Mercoid Pressure Controls

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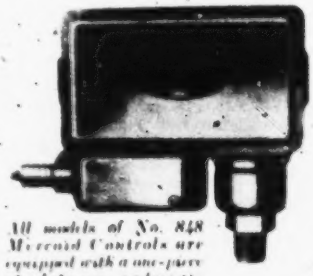
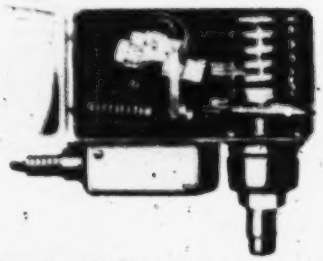


*All models of No. 848 Mercoid Controls are equipped with a one-piece steel cover, cadmium plated, hinged with catch. One special order can be furnished with steel cover, arranged to snap on without hinge.*



The No. 848 Mercoid pressure controls give exceptionally close and accurate regulation.

They are particularly adapted for stoker control when the boiler pressure exceeds 15 pounds.

By means of the double adjustment the instrument can easily be set for the required range and differential. All models can be furnished with indicator and outside adjustment with key when so ordered.

Cadmium plated throughout to prevent corrosion. Threaded connection ½" male and ¼" female I.P.S.

### Adjustable Ranges and Differentials

| Model | Adjustable Operating Range | Differentials Minimum to Maximum |
|---|---|---|
| B-1 | 10 lbs. to 60 lbs. | 1½ lbs. to 10 lbs. |
| B-2 | 30" vac. to 45 lbs. | 2 lbs. (4" vac.) to 18 lbs. (30" vac.) |
| B-4 | 50 lbs. to 100 lbs. | 2 lbs. to 15 lbs. |
| B-6 | 0 lbs. to 200 lbs.<br>50 lbs. to 250 lbs. | Low Range 2 lbs. to 10 lbs.<br>High Range 3 lbs. to 8 lbs. |
| C | 3" vac. to 3½ lbs. | 1 oz. to 8 oz. |

Models Available for Pressures up to 700 lbs. Write for information.

### Fig. 31 Mercoid Pressure Control

*PAT. ISSUED 1621[illegible], 1640[illegible] 1787[illegible] 1792[illegible] OTHERS PENDING*

The Fig. 31 Mercoid pressure control is a positive safety limiting device, actuated by a specially designed Bourdon tube of great strength and elasticity. The snap action movement locks the switch in position at both the cut-in and cut-out points.

This instrument, of rugged construction and inexpensive design, is particularly adapted for stoker control where very close regulation is not required.

*Figure 31*

*Back View*

ADJUSTMENTS

*All types have a simple adjustment for raising or lowering the cut-in and cut-out points.*

- *Improved type outlet box with outside screws for making quick electrical connections.*
- *A sealed hand reset button for test purposes.*
- *Hand adjustment for raising or lowering the boiler control setting.*

All working parts of brass or nickel silver, with black heat resisting finish on case and cover. Threaded connection, ¼" male I.P.S.

In ordering specify the exact cut-in and cut-out pressures required. The pressure difference must not be less than the minimum differentials shown below, for any respective range. By means of the hand adjustment on the back of the case the pressure operating range can be adjusted within the limits shown. The differential as ordered is set at the factory and will remain constant over the entire adjustable range.

### Range, Differential and Adjustment Data

Standard Range: 1 to 4 lbs. adjustable 7 to 10 lbs.

| Ranges Up to | Minimum Differentials | Maximum Range Adjustment |
|---|---|---|
| 16 lbs. | 3 lbs. | 6 lbs. |
| 25 lbs. | 4½ lbs. | 7 lbs. |
| 35 lbs. | 5 lbs. | 10 lbs. |
| 50 lbs. | 6 lbs. | 15 lbs. |
| 65 lbs. | 8 lbs. | 30 lbs. |
| 80 lbs. | 10 lbs. | 40 lbs. |
| 150 lbs. | 15 lbs. | 55 lbs. |
| 250 lbs. | 25 lbs. | 105 lbs. |

When ordering, specify exact Cut-In and Cut-Out Pressures required.

### LIST PRICES

| Model | Range | List |
|---|---|---|
| No. 858 AA-3 | 10" vac. to 15 lbs. | $22.00 |
| No. 848 B-1 | 10 lbs. to 60 lbs. | 30.00 |
| No. 848 B-2 | 10" vac. to 45 lbs. | 32.00 |
| No. 848 B-4 | 50 lbs. to 100 lbs. | 35.00 |
| No. 848 B-6 | 0 lbs. to 200 lbs. | 40.00 |
| No. 848 B-6 | 50 lbs. to 250 lbs. | 40.00 |
| No. 848 C | 3" vac. to 3½ lbs. | 38.00 |
| Fig. 31 | 1 to 4 lbs. adjustable 7 to 10 lbs. | 18.00 |
| Fig. 31 | Ranges up to 30 lbs. | 21.00 |
| Fig. 31 | Ranges between 30 and 150 lbs. | 24.00 |
| Fig. 31 | Ranges between 150 and 300 lbs. | 28.00 |

# MERCOID COMBINED PRESSURE AND LOW WATER CONTROLS

## PROTECT YOUR BOILER AT THE WATER LEVEL

The rapid increase in the use of automatic coal stokers, and the improvements in the performance of this equipment, have been such that frequent visits to the boiler room have become unnecessary. This condition has produced the need for low water protection, since the low water line is no longer frequently checked.

The Mercoid Low Water and Pressure Control was designed primarily to prevent the hazard of firing into dry boilers, but also guards against building up excessive steam pressure.

The float housing is of neat and sturdy design. Its two-piece construction enables the switch to be detached from the bowl, a convenience in making installation. For low pressure work close-grained cast iron is used in the bowl housing castings and for high pressure service semi-steel.

The shaft is of non-corrosive stainless iron, ground and lapped to remove any imperfections in its surface, insure freedom of operation and eliminate the necessity for frequent repacking.

Four and one-half inch diameter heavy seamless copper floats are used for pressures up to 150 lbs. For pressures exceeding 150 lbs. up to 300 lbs., welded steel floats with a heavy electro-deposited nickel coating are used.

Equipped with the Fig. 9-51 Mercoid tipless switch, the latest development in mercury sealed contact switches. Perfect electrical contact is assured indefinitely.

## Mercoid Figure 71

### For Complete Protection

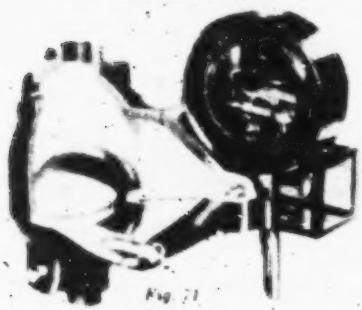


*Fig. 71*

*Sectional View*

The Figure 71 control consists of a Mercoid switch, mounted on a snap action mechanism, actuated by a Bourdon tube responsive to steam pressure from the boiler and also by a float responsive to the water level in the boiler. The use of the Bourdon tube permits a selection of pressures up to and including 300 lbs.

It is arranged to break circuit to the burner when the water level falls or when the steam pressure rises to a predetermined point. While either condition exists the circuit remains open. It is regularly supplied fully automatic, but is made semi-automatic where so specified.

Standard Range, 1 to 4 lbs., adjustable to 7 to 10 lbs.

### Available Ranges
### (Other Than Standard)

| Setting | Adjustable | Setting | Adjustable |
|---|---|---|---|
| 0 to 2 lbs. | 1 to 3 lbs. | 5 to 8 lbs. | 9 to 12 lbs. |
| 2 to 3 lbs. | 2 to 4½ lbs. | 5 to 10 lbs. | 10 to 15 lbs. |

For higher pressures, refer to "Range, Differential and Adjustment Data," page 4, which applies also to this type of control.

## Mercoid Figure 72

### For Low Water Only

The Figure 72 Low Water Control is for use on boilers up to 300 lbs. pressure and is suitable for installations already equipped with Mercoid pressure controls, which need

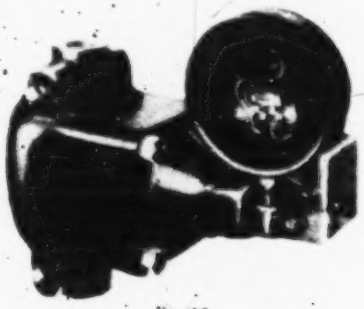


*Fig. 72*

not be disturbed. It is regularly supplied fully automatic but is made semi-automatic where specified.

## Mercoid Figure 73

### For Vapor or Vapor-Vacuum

*In connection with diaphragm regulator*

The Figure 73 control has been designed for use where regulators are available on the boiler, such as vapor or vapor-vacuum systems having standard equipment floats or

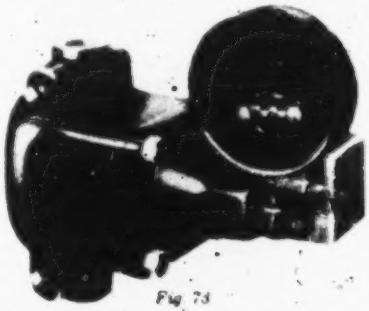
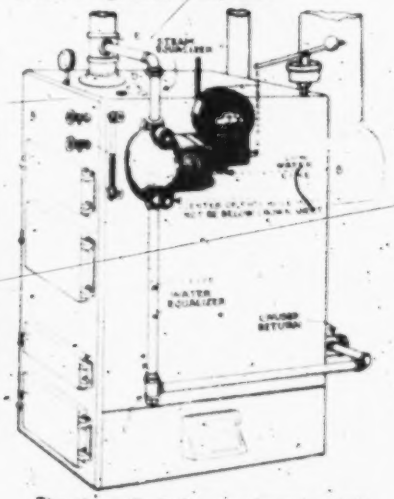


*Fig. 73*

diaphragms. The unit may be attached on such installations and positive operation assured, particularly suitable where very close pressure regulation is essential.




The above illustration is a typical installation of Figure 73 Low Water Switch in connection with diaphragm regulator for pressure control, which has been found very desirable for stoker application.

### LIST PRICES

When ordering Fig. 71 Controls, be sure and specify exact Cut-In and Cut-Out Pressures required.

| | | |
|---|---|---|
| Fig. 71 | Single Pole, 10 Amp.-110 V., 5 Amp.-220 V. Standard Range 1 to 4 lbs., adjustable 7 to 10 lbs. | $36.60 |
| Fig. 71 | Single Pole, 10 Amp.-110 V., 5 Amp.-220 V., for Pressures up to 30 lbs. | 40.00 |
| Fig. 71 | Single Pole, 10 Amp.-110 V., 5 Amp.-220 V., for Pressures from 30 up to 150 lbs. | 52.00 |
| Fig. 71 | Single Pole, 10 Amp.-110 V., 5 Amp.-220 V., for Pressures from 150 up to 300 lbs. | 65.00 |
| Fig. 72 and 73 | Single Pole, 10 Amp.-110 V., 5 Amp.-220 V., for Pressures under 150 lbs. | 34.00 |
| Fig. 72 and 73 | Single Pole, 10 Amp.-110 V., 5 Amp.-220 V., for Pressures from 150 up to 300 lbs. | 54.00 |
| For Double Pole, add to lists | | 4.00 |
| When equipped with Fig. 9-61 Switch, 3 Amp.-110 V., 1½ Amp.-220 V., deduct from list | | 1.50 |

# MERCOID TEMPERATURE CONTROLS
## FOR HOT WATER HEATING BOILERS OR STORAGE TANKS

Mercoid temperature controls are recommended wherever positive and dependable regulation of boiler temperatures is necessary. Many types and ranges are available, but the following are particularly adapted for use with automatic stokers and forced draft coal burning equipment.

They can be used separately to maintain a relatively constant boiler temperature, but when used in connection with the Mercoid room thermostat fuel economies will be effected and the room temperature will be held closely within the desired limits.

### Fig. 35 Mercoid Risertherm
Sensitive Type

PAT. ISSUED [illegible] OTHERS PENDING

The Mercoid Risertherm, of simple design and sturdy construction, is a temperature limiting device which can quickly be clamped

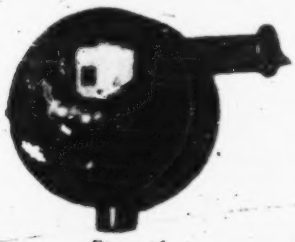


*Figure 35*

on risers of hot water boilers or to the surfaces of hot water tanks.

Simplicity of installation and ease of adjustment are outstanding features. Can be quickly set to operate at any desired temperature between 110 and 200 degrees F. The differential, or temperature difference between the cut-in and cut-out points is

*Figure 37 Mounted on Vertical Pipe*

from 10 to 18 degrees, depending upon the size of pipe and rate of temperature change.

The same instrument can be used for either vertical or horizontal pipe mounting.

Improvements in this switch make it particularly sensitive to changes in riser temperature, and close operation and reliable performance are assured. The thermal operating elements are seasoned at high temperatures for a long period of time to insure against leakage, and the completed controls are carefully assembled and individually tested before shipment is made.

### Fig. 36 and 37 Immersion Controls

PAT. ISSUED [illegible] OTHERS PENDING

*Figure 36 Straight Stem*

The Mercoid immersion type controls have a background of ten years of dependable service.

They are very sturdy in construction, and since they operate directly from the water temperature there is no lag in the instrument, thus assuring very positive and accurate regulation.

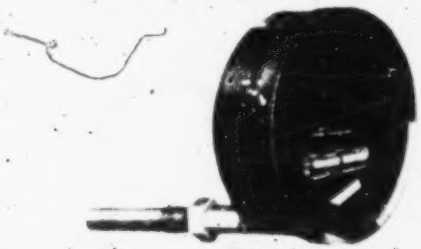


*Figure 37 Bulb Angle Stem*

The standard range is 140 to 165 but each instrument has a simple thumb adjustment for raising the operating point to as high as 214°. The differential of 25° at the low range decreases as the range is raised, and is as close as 14° at the high range.

Due to its low price, the wide range adjustment which will meet practically all operating conditions, and its dependable service free operation, this instrument is particularly recommended for stoker applications.

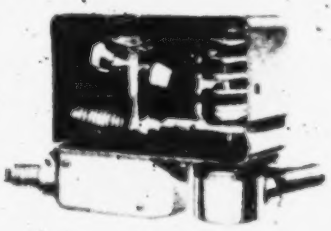
### No. 848 Models G-1 and G-2
PAT. ISSUED [illegible] OTHERS PENDING

The No. 848 Models G-1 and G-2 immersion type Mercoid controls are recommended for stoker control when exceptionally close regulation is required.

*Model G-1*
*Height Overall 3½"*

They are provided with both range and differential adjustments. The range is adjustable for any operating temperature between 110 and 220° F., and the differential can be set as close as 3° to as wide as 30°.

Cadmium plated throughout to prevent corrosion. Threaded connection, ½", male I P S.



*Model G-2*
*Back or Side Angle Connection*

Lower or higher ranges available. Write for information.

### LIST PRICES

| | | |
|---|---|---|
| Fig. 35 | Risertherm, 110 to 220° F., 10 Amp. | $18.00 |
| Fig. 36 | Immersion, 140 to 165°, adjustable to 214°, 10 Amp. | 18.00 |
| Fig. 37 | Immersion, 140 to 165°, adjustable to 214°, 10 Amp. | 20.00 |
| No. 848 | Model G-1, 110 to 220°, 10 Amp. | 12.00 |
| No. 848 | Model G-2, 110 to 220°, 16 Amp. | 14.00 |

# TYPE M-61 STOKER CONTROL

The Type M-61 Mercoid Stoker Control has many outstanding features. It is sturdily constructed and has the advantage of a simple double adjustment, for both "high" and "low" operating temperatures, to meet the variety of conditions encountered in stoker installations. Range adjustable from 50 to 650° F.

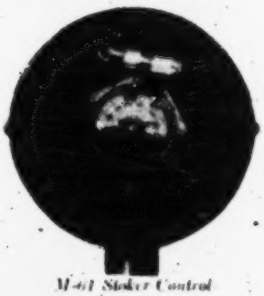
The temperature indicator located over the dial serves the same purpose as a thermometer, and will assist at the time installation is made in determining the proper size of fire required and in correctly setting the controls.

The efficiency and general operation of a stoker will be improved by the use of the Type M-61 Mercoid Stoker Control.

When this control is mounted in the stack, set for a low operating temperature, approximately 115 to 130° F., and connected in parallel with the thermostat circuit, it will operate the stoker intermittently for short periods at a time, when the thermostat is in the "off" position. This will not only prevent the fire from going out, but will also maintain a low and even fire bed. (See wiring diagrams.)

When the Fig. M-61 Mercoid Stoker Control is connected in series with the thermostat circuit, and set for a high operating temperature (from 300 to 450° F., depending upon boiler capacity and load on system) the efficiency of the stoker will be increased and fuel will be saved.

When the stoker is firing continuously due to the thermostat calling for heat, the combustion gases will continue to increase in temperature. After



*M-61 Stoker Control*

*Side View*

PAT. ISSUED 1881 1887 1889 1890 1892 OTHERS PEND.

a certain temperature is reached, the boiler will be operating at its maximum capacity and further firing would only increase the stack temperature with a resultant waste of fuel. The Mercoid control will stop the stoker from the increase in stack temperature, and the boiler will continue to absorb the heat from the glowing fire bed. When the stack temperature lowers sufficiently the Mercoid control will again start the stoker. This operation will be repeated until the thermostat cuts off.

The Type M-63 Mercoid Stoker Control is identical to the Type M-61 except that it breaks the circuit on a dropping temperature. This control can be employed as an additional safety where required and so set that it will open the circuit and stop the stoker operation in the event the temperature should drop below 100° F. This lower temperature would be reached only in the event the fire had gone completely out, and this control would prevent the stoker from running continually and filling the boiler with fresh coal. A snap switch connected around this control would permit operation of the stoker while the fire was being started.

## Type M-51 and M-52 Warm Air Furnace Controls

The Type M-51 Mercoid Control has been designed to prevent the overheating of stoker fired warm air furnaces.

It is identically the same as the Fig. M-61 stoker control, except that it has an adjustable mounting flange and a longer sleeve which permits the bimetal operating coil to extend farther into the furnace. By means of the adjustable flange the instrument can be easily installed on any furnace hood where the angle is from 30 to 90 degrees.

The Type M-52 Mercoid Control is identically the same as the Type M-51, except that it has two separate circuits, the one closing on a dropping temperature and the other on a rising temperature.

On a stoker fired warm air furnace equipped with an air circulating fan, this control serves a dual purpose. It will intermittently fire the stoker for short periods at a time when the thermostat is in the "off" position, and will permit operation of the circulating fan only when the thermostat is calling for heat and the furnace is heated. (See wiring diagram No. 3.)

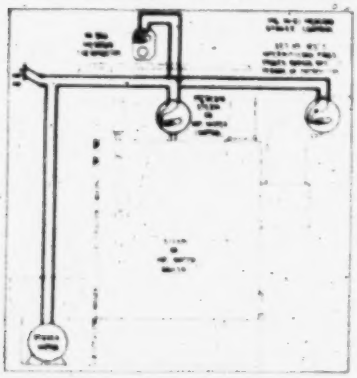


*Diagram No. 1*

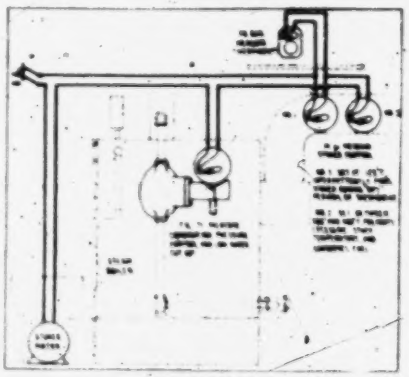


*Diagram No. 2*

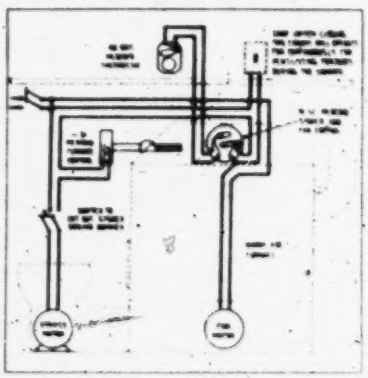


*Diagram No. 3*

**LIST PRICES**

| | Single Pole | Double Pole | Two Circuit |
|---|---|---|---|
| Type M-61 Stoker Control, 10 Amp | $18.00 | $22.00 | |
| Type M-63 Stoker Control, 10 Amp | 18.00 | 22.00 | |
| Type M-51 Furnace Control, 10 Amp | 18.00 | 22.00 | |
| Type M-52 Furnace Control, 10 Amp | | | $22.00 |

Shipping Weight, 4 lbs., 14 oz.

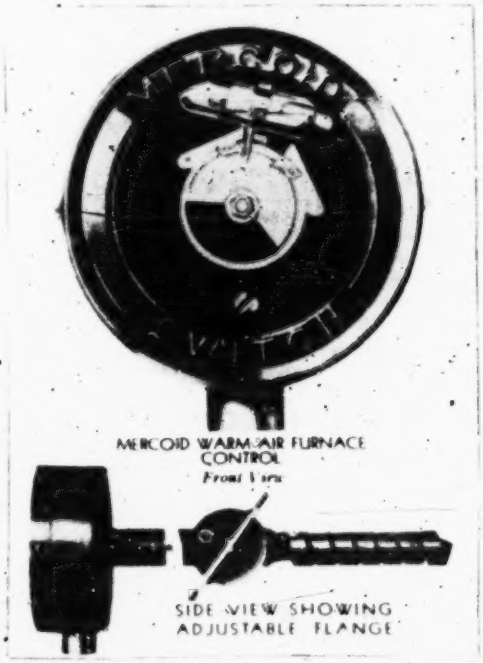
# MERCOID WARM AIR FURNACE CONTROLS

## FOR LIMITING TEMPERATURE OR CONTROLLING BOOSTER FANS

PATENT NUMBERS [illegible] OTHERS PENDING

The Mercoid Warm Air Furnace Control is neat in appearance and is constructed to render dependable service.

This instrument can be furnished to automatically open or close an electric circuit with a change in temperature on the bi-metal coil. It is generally employed on warm air furnaces, to control the operation of booster circulating fans, or as a safety limit control to prevent overheating of the furnace. It is adaptable, however, to many other applications in both the domestic and industrial fields, as it is available with a special bi-metal coil which gives very close temperature regulation on air or other non-corrosive gases.



MERCOID WARM AIR FURNACE CONTROL
*Front View*

SIDE VIEW SHOWING ADJUSTABLE FLANGE

The adjustable flange permits the mounting of this control on any furnace hood, as it is adjustable for any angle between 30 and 90 degrees. Installation is easily made by means of four sheet metal screws, and the tightening of only one nut firmly locks both the instrument and flange in the correct position. For applications on brick covered furnaces or other flat surfaces, a straight 90° non-adjustable flange can be furnished on special order at no additional charge.

The Mercoid switch is of the enclosed mercury contact type. It is not subject to open arcing, corrosion, oxidation, or pitting and will operate indefinitely without any deterioration. The mechanism of this control has many outstanding features. The dial, located in the center of the instrument, slowly rotates as the temperature on the bi-metal coil increases or decreases. This dial is clearly calibrated in degrees Fahrenheit, and a pointer indicates the temperature in the furnace or duct, enabling the installation or service men to check the proper size of fire.

When a temperature is reached corresponding to the control setting, the Mercoid switch is tipped to either the "on" or "off" position. A strain release is provided which prevents injury to the mechanism or bi-metal coil when the temperature goes either above or below the normal operating range.

A simple double adjustment is provided for setting both the "high" and "low" operating points. The range can be adjusted over the entire scale and the differential can be set for very close operation or can be widened to meet any field requirements.

On standard instruments the combined length of the bi-metal coil and metal sleeve projecting from back of the case is 14½ inches. Metal sleeves longer or shorter than standard can be furnished on special order to meet unusual requirements.

## FURNACE LIMIT CONTROLS TYPE M-51 AND M-52

TYPE M-51 Mercoid control, as described above, is generally used as a safety limit control to prevent the overheating of warm air furnaces in connection with automatic fuel burning systems.

This instrument has an adjustable range from 50° to 650° and can be quickly set to open the circuit on a rising temperature at any point within this range.

The Type M-51 Limit Control insures protection against extreme overheating, and should be used on all warm air installations. The National Board of Fire Underwriters' ruling (136E) reads "Where automatic operation is provided the installation shall be equipped with approved limiting devices to prevent abnormal temperatures in hot air furnace ducts."

TYPE M-52 Mercoid Control has the same range as Type M-51, but is supplied with two separate circuits, for use with three wire systems where it is required that one circuit be made and the other broken simultaneously. This instrument is adaptable for use with three wire low voltage systems.

(Over)

# MERCOID WARM AIR FURNACE CONTROLS (Continued)

## MERCOID WARM AIR FAN CONTROL TYPE M-53

TYPE M-53 Mercoid Control, as illustrated and described on the opposite page, is the ideal control for all types of Blower or Booster Fan applications. It may be applied on any warm air furnace where coal, oil or gas is used for fuel. The efficiency of a warm air furnace is greatly increased through the use of a Mercoid-controlled furnace fan. Troublesome jobs can be corrected, and rooms remote from the furnace can be adequately heated by means of the forced circulation. The Mercoid M-53 control operates the fan economically, and prevents blowing cold air into the room if the furnace is not hot enough to deliver heat.

The instrument has an adjustable range from 50° to 650° F. It is generally set to operate somewhere between 120° and 150° F., but this may be varied to meet individual conditions. The fan operates when the furnace temperature is 150° or higher, and stops when the temperature drops to 120° or less. Where exceptionally close regulation is required Type M-57 is recommended.

## FOR CLOSE TEMPERATURE REGULATION TYPE M-55, M-56, M-57

TYPE M-55 Mercoid control is of the same general construction as the Furnace control illustrated and described on the opposite page, except that it is furnished with a longer bi-metal coil which is very sensitive to temperature changes.

This instrument has an adjustable range from 40° to 280° F. and is designed to open the circuit on a rising temperature.

There are many applications for this type control where close temperature regulation is desired in air ducts, dryers or ovens. Electrically heated cabinets can be directly controlled where the load is within the switch capacity.

TYPE M-56 Mercoid control is the same as Type M-55 except that it is supplied with two separate circuits, one opening and the other closing simultaneously.

TYPE M-57 Mercoid control is the same as Type M-55 except that it is arranged to close the circuit on a rising temperature.

## STANDARD DIALS USED ON MERCOID FURNACE CONTROLS

Standard for Type M-51 or M-52 | Standard for Type M-53 | Standard for Type M-55, M-56 or M-57

Standard instruments are furnished with bi-metal coils which operate in accordance with graduations on dials as shown.

Note that Type M-51 dial has wide graduations at the top of its range and thus gives close regulation at high temperatures. Type M-53 gives very close regulation at low temperatures but is not sensitive at high temperatures.

If Type M-51 is desired to give close operation at low temperatures, it can be furnished, at no extra charge, with Type M-53 coil and dial when so ordered. Type M-53 control can also be supplied with Type M-51 coil and dial to give close operation at high temperatures.

Type M-55 dial is graduated evenly and gives extremely close regulation at any point on its range.

## ELECTRICAL SPECIFICATIONS

All Mercoid Furnace Controls are furnished standard with a normal rating of 10 amperes at 110 volts, 5 amperes at 220 volts either A.C. or D.C. They will directly handle, without the use of a relay, motors within the following capacities:

| | |
|---|---|
| Repulsion-Induction | 1 H.P. |
| Direct Current | ½ H.P. |
| Split Phase | ½ H.P. |

All types can be furnished with a normal rating of 4 amperes at 110 volts, 2 amperes at 220 volts, either A.C. or D.C. at reduced list prices.

Mercoid controls automatically regulate motors of the largest size when used as a pilot switch in connection with the proper motor starting switch.

For the control of non-inductive A.C. electric heater loads, all furnace controls can be supplied at slight additional charge with special Mercoid switches capable of directly handling 20 amperes 110 volts (2000 watts) or 20 amperes 220 volts (4000 watts).

## ORDERING DATA

When ordering standard controls, specify type number of instrument desired. Unless otherwise specified, instruments will be furnished with capacity of 10 amperes 110 volts, 5 amperes 220 volts, and with adjustable type flange.

When special controls are required, complete information must accompany order.

## LIST PRICES

| Mercoid Furnace Controls | Single Pole Single Throw | | Single Pole Double Throw | | Double Pole Single Throw | |
|---|---|---|---|---|---|---|
| | 10 Amp | 4 Amp | 10 Amp | 4 Amp | 10 Amp | 4 Amp |
| Type M-51, Limit Control, 50°-650° F | $16.00 | $14.50 | | | $20.00 | $17.00 |
| Type M-52, Limit Control, 50°-650° F | | | $20.00 | $17.00 | | |
| Type M-53, Fan Control, 50°-650° F | 16.00 | 14.50 | | | 20.00 | 17.00 |
| Type M-55, Temperature Control, 40°-280° F | 18.00 | 16.50 | | | 22.00 | 19.00 |
| Type M-56, Temperature Control, 40°-280° F | | | 22.00 | 19.00 | | |
| Type M-57, Temperature Control, 40°-280° F | 18.00 | 16.50 | | | 22.00 | 19.00 |

SHIPPING WEIGHT APPROXIMATELY 3 POUNDS



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# MERCOID STOKER CONTROL TYPE M-61

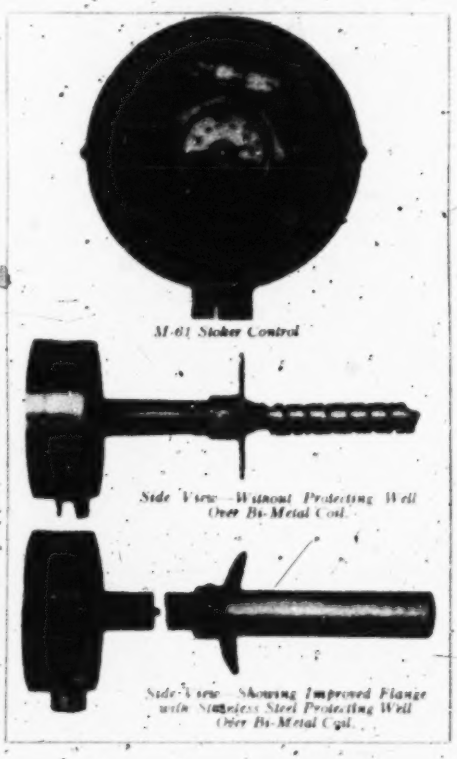
## FOR INTERMITTENTLY FIRING COAL STOKERS—MAINTAINS LOW AND EVEN FIREBED IMPROVED TYPE—WITH STAINLESS STEEL PROTECTING WELL OVER BI-METAL COIL

PATENTS ISSUED 15,331 1,598,874 1,640,869 1,700,969 1,756,967 1,767,496 OTHERS PENDING

The Type M-61 Mercoid stoker control has many outstanding features which improve the efficiency and general operation of a coal fired stoker.

This instrument is generally employed to fire the stoker intermittently during the period the room thermostat is in the "off" position, but may be used to limit the stack temperature. Type M-63 is used to stop the stoker if the fire dies out.

Particular attention is called to the dial in the center of the instrument which is clearly and accurately calibrated from 50° to 650° F. A simple double adjustment is provided for individually setting both the "cut-in" and "cut-out" operating temperatures at any point within the instrument's range. This desirable feature permits quick setting to meet the variety of conditions encountered in stoker installations.



M-61 Stoker Control

Side View—Without Protecting Well Over Bi-Metal Coil.

Side View—Showing Improved Flange with Stainless Steel Protecting Well Over Bi-Metal Coil.

Another feature of decided importance is the temperature indicator located over the dial, which indicates in degrees Fahrenheit the temperature within the stack. Serving the same purpose as a thermometer, this temperature indicator assists at time of installation in determining the proper size of fire required and in correctly setting the controls.

### IMPROVED MOUNTING

We recommend the use of the improved type mounting flange and stainless steel well with sealed end for enclosing the bi-metal coil. This protects the sensitive bi-metal coil not only from deposits of fly ash, but also against corrosive action of the stack gases, so that frequent readjustments are not required to compensate for change in the operation of the bi-metal coil. This new feature can be supplied for instruments now in the field without this protection.

### ENCLOSED CONTACT

The Mercoid switch with its hermetically sealed mercury contact is immune to oxidation, dirt or corrosion. Burning, pitting and sticking,—sources of service trouble and expense with open-to-air contacts,—cannot occur with the sealed Mercoid switch. The contact remains permanently clean and the free flowing mercury insures perfect electrical contact at every operation.

### CONSTRUCTION

The 4¾" steel case has a black heat resisting finish. The semi-glass cover is removable by loosening two screws. The wiring is simplified by means of ½" BX connection at bottom, and terminal posts within the case. A bakelite shield over the terminal posts prevents possibilities of shock while changing the control temperature setting.

See Other Side For Specifications and Prices

# MERCOID STOKER CONTROL TYPE M-61 (Continued)

## OPERATION

The high temperature bi-metal coil which is the operating element of this instrument is carefully heat treated to insure uniform and reliable operation. As the stack temperature increases or decreases this element revolves a stainless steel shaft which rotates the inner mechanism thus operating the Mercoid switch and at the same time indicating the stack temperature on the graduated dial. A relief spring is provided which permits the bi-metal coil to continue its natural course after the switch has been thrown to the "on" or "off" position, without straining this element.

When the room thermostat is in the "off" position the stoker fire gradually dies down, and may go out unless it is intermittently fired for short periods. As the fire dies down the stack temperature slowly decreases. When the type M-61 control is mounted in the stack, set for a low operating temperature, approximately 115° to 130° F., and connected in parallel with the thermostat circuit, it operates the stoker intermittently for short periods while the thermostat is in the "off" position. This not only prevents the fire going out, but also maintains a low and even fire bed. (See wiring diagrams.

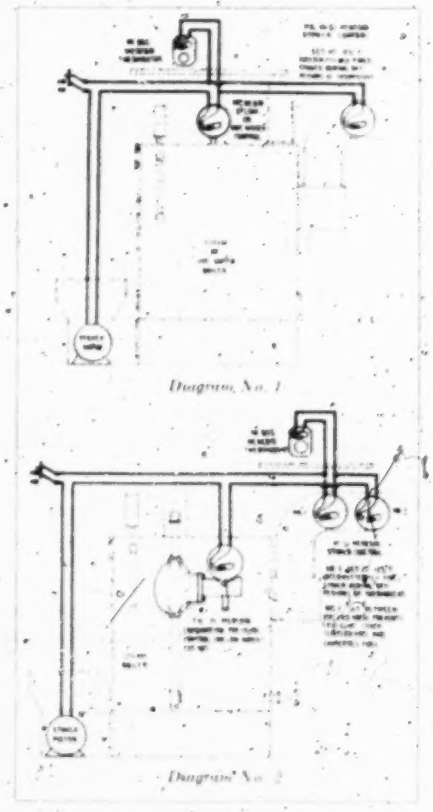


Diagram No. 1

Diagram No. 2

When the Fig. M-61 Mercoid Stoker Control is connected in series with the thermostat circuit, and set for a high operating temperature (from 300° to 450° F., depending upon boiler capacity and load on system) the efficiency of the stoker is increased and fuel saved.

When the stoker is firing continuously due to the thermostat calling for heat, the combustion gases continue to increase in temperature. After a certain temperature is reached, the boiler is operating at its maximum capacity and further firing only increases the stack temperature with a resultant waste of fuel. The Mercoid control stops the stoker from the increase in stack temperature, and the boiler continues to absorb the heat from the glowing fire bed. When the stack temperature lowers sufficiently the control again starts the stoker and repeats this operation until the thermostat cuts off.

### TYPE M-63 STOKER CONTROL

Type M-63 is the same as Type M-61 except that it breaks the circuit on a dropping temperature. Set to stop the stoker by opening the circuit when the temperature drops to a low point (approximately 100° F.) it prevents filling the boiler with fresh coal when the fire is out. A snap switch connected around this control permits operation of the stoker while the fire is being started.

## ELECTRICAL SPECIFICATIONS

Mercoid stoker controls are furnished standard with a normal rating of 10 amperes at 110 volts, 5 amperes at 220 volts either A.C. or D.C. They directly handle without the use of a relay, motors within the following capacities:

| | |
|---|---|
| Repulsion-Induction | 1 H.P. |
| Direct Current | ½ H.P. |
| Split Phase | ½ H.P. |

Mercoid controls automatically regulate motors of the largest size when used as a pilot switch in connection with the proper motor starting switch. For this service they can be furnished with a normal rating of 4 amperes at 110 volts, 2 amperes at 220 volts, either A.C. or D.C. at reduced list prices.

## ORDERING DATA

When ordering specify type number of instrument, electrical capacity, and type of mounting flange desired. Unless otherwise specified, instruments are furnished single pole, 10 ampere with improved type mounting flange and stainless steel well.

## LIST PRICES

| Mercoid Stoker Control | Single Pole, Single Throw, 10 Amp. |
|---|---|
| Type M-61 or M-63, 50° to 650°, plain flange (without well) | $14.50 |
| Type M-61 or M-63, 50° to 650°, improved flange with stainless steel well | 18.50 |

SHIPPING WEIGHT, APPROXIMATELY 4 lbs. 8 oz.



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# INSTALLATION INSTRUCTIONS

## MERCOID STOKER CONTROLS

### TYPES M-61, M-62, M-63

Patents Issued: 15,531, 1,398,874, 1,640,869, 1,705,989, 1,758,957, 1,757,436, Others Pending

### IMPORTANT—NOTE

After removing all packing material, note tag warning not to twist the bi-metallic element. To do so may distort the metal and disarrange the adjustment which is correctly made at the factory. The Mercoid switch is wired in place to protect it during shipment. This wire must be removed after instrument is installed.

### MOUNTING

Carefully determine the location of the instrument. It is usually placed about two feet from the furnace, on the most convenient side of the stack. The correct location, however, depends upon the operating characteristics of the boiler. If the stack temperatures are high this instrument must be located at a greater distance from the boiler. A location should be decided on where the maximum stack temperature will not exceed 650° F., and where the instrument will not be covered with fly ash. If located close to the furnace, the temperature changes occur quickly and the resulting frequent operations are objectionable. If this control is located between the check draft and chimney, the check must not be operated, as the cold air admitted quickly cools the instrument and causes unnecessary operations.

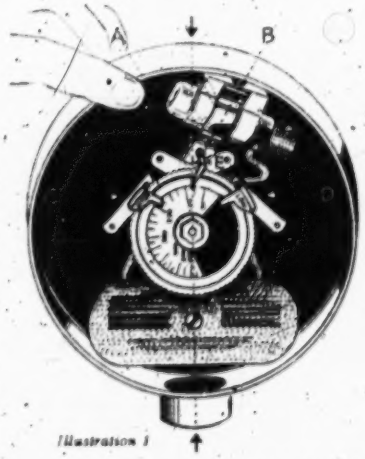

Illustration 1

Cut a 1¼" hole directly on the side of the stack so that the stem of the instrument will be horizontal when mounted. Insert the stainless steel well and attach flange to stack by means of four screws provided. Insert the instrument bi-metal coil into stainless steel protecting well as far as it will go, then back out ½" and securely fasten instrument into flange by tightening set screw.

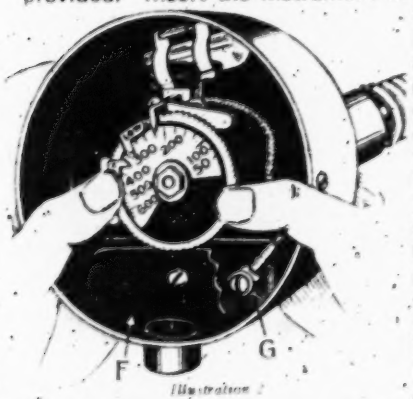

Illustration 2

Before tightening set screw, see that the instrument is level and also lined up vertically. This may be determined by separating the "high" and "low" adjustable pointers, "C" and "D", illustration 1, until they hold the switch kicking plates away from the switch tripping arm "E." The switch must move freely from left to right without interference of the kicking plates. If the switch remains at either the right or left after tilting with the finger, the instrument is ready to be fastened by tightening lock nut on flange.

### ADJUSTMENT

The instrument can now be adjusted to the desired operating point. When setting the cut-in and cut-out points, hold the ratchet wheel firmly with one hand while pressing and moving either the high or low pointer; see illustration 2. When pressing pointers see that the catch between the teeth of the ratchet wheel is disengaged, as shown in "I," illustration 3.

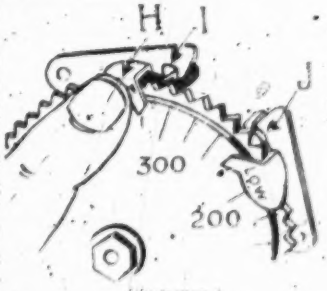

Illustration 3

### CAUTIONS

At no time should the instrument be subjected to more than 800 degrees Fahrenheit. If subjected to higher temperatures the calibration of the instrument will change and cause unsatisfactory operation. The instrument leaves the factory with the bi-metallic element properly formed, heat-treated, stabilized and calibrated. Should the temperature reading be in error due to an accidentally twisted bi-metallic element, if not excessively twisted it may be readjusted by allowing the instrument to reach room temperature, loosening the nut in the center of the dial and moving dial until correct reading is obtained, after which the nut should be tightened. Any manual twisting or bending of the element may permanently distort it. Not only will this destroy the correct calibration of the instrument but also the accurate performance after adjustment is made. In case the bi-metallic element is badly distorted a new element should be ordered for replacement. In ordering element the serial number of the instrument should be supplied.

DO NOT OIL ANY BEARINGS

### WIRING

Illustration 4

Remove insulating plate indicated as "F" in illustration 2, by removing screw located in center of plate. Scrape and clean the wires and carefully place around the terminal screws, and in the groove provided, see illustration 4. After wiring, fasten insulating plate back in position. Be sure the connected load is not in excess of the controls rating as shown on the name plate. Fuses installed in the line should not exceed 10 amperes at 110 volts or 5 amperes at 220 volts.


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# GENERAL APPLICATIONS AND WIRING DIAGRAMS

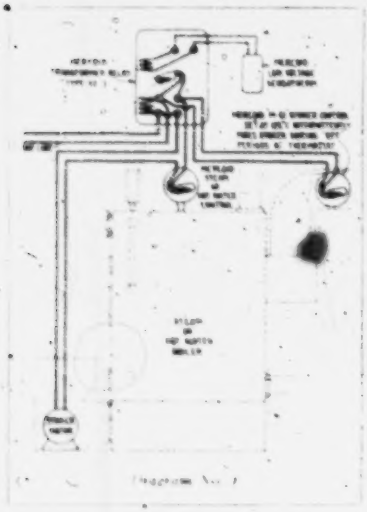


Diagram No. 1

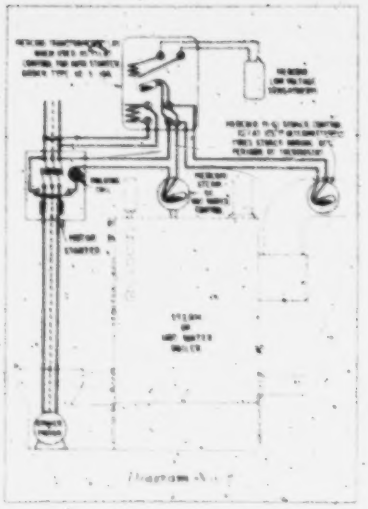


Diagram No. 2

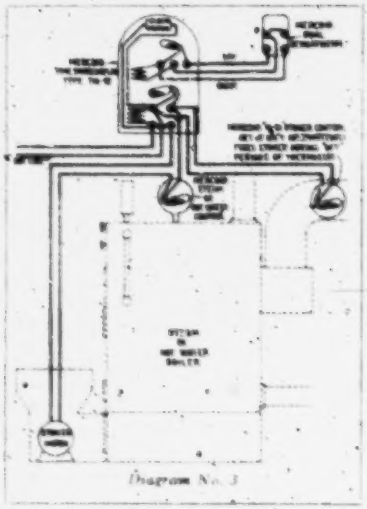


Diagram No. 3

DIAGRAM No. 1 shows the general hook-up in connection with domestic stokers where the motor load can be directly handled by the controls. When the Type M-61 stoker control is connected in parallel with the relay circuit and set for a low operating temperature, approximately 115 to 190° F., it operates the stoker intermittently for short periods when the room is up to temperature and the Sensatherm has the relay in the "off" position. This not only prevents the fire from going out, but also maintains a low and even fire bed.

DIAGRAM No. 2 shows the hook-up when large stoker motors are employed which require the use of automatic motor starters. This same hook-up applies also when two or three phase motors of any size are employed. The motor starter affords protection against over-load or single phasing. Type M-61 stoker control functions the same as in diagram No. 1.

DIAGRAM No. 3 is identical to diagram No. 1 with the exception that a dual Sensatherm is employed with an electric Time Switch Relay and affords DAY and NIGHT temperature control. At a pre-determined hour in the evening the clock transfers the room temperature control from the day setting to the night setting of the Dual Sensatherm. A lower room temperature is then maintained until the pre-determined set time in the morning when the clock again transfers the control to the day setting of the Sensatherm. Type M-61 stoker control functions to maintain the fire regardless of whether the Dual Sensatherm is operating on its day or night setting.

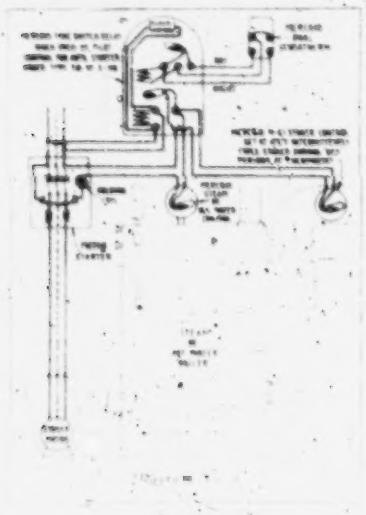


Diagram No. 4

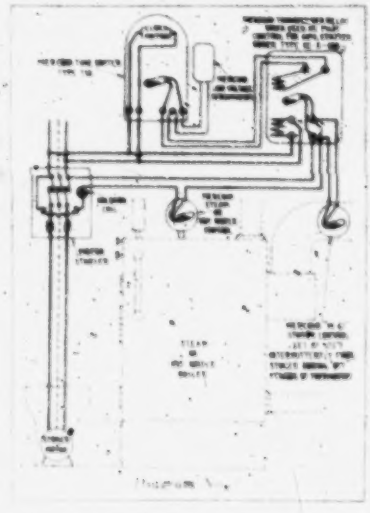


Diagram No. 5

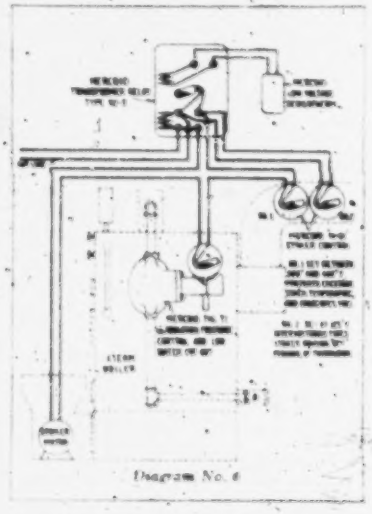


Diagram No. 6

DIAGRAM No. 4 shows the hook-up where DAY and NIGHT temperature control is desired in connection with stokers employing large motors or motors operating on two or three phase current. The controls operate in the same manner as explained under diagram No. 1 and the motor starter provides over-load and single phase protection.

DIAGRAM No. 5 shows the hook-up for large stoker installations where a thermostat controls the room temperature during the day, but at night when the fire is banked an electric time switch opens the thermostat circuit. The M-61 stoker control then prevents the fire going out until early morning when the time switch again places the thermostat in control. This circuit hook-up applies on jobs where controls were originally installed as per diagram No. 2, and the time switch feature added at a later date. On new installations where this hook-up is desired the time switch and transformer relay can be furnished in a combination unit (Type V2-3-118).

DIAGRAM No. 6 shows the application of Type M-61 stoker control on installations where high stack temperatures are encountered. Instrument No. 1 intermittently fires the stoker during the periods the room is up to temperature and the Sensatherm has the relay in the "off" position. Instrument No. 2 is connected in series with the relay, and when set for a high operating temperature (350 to 500° F., depending upon boiler capacity and load on system) increases the efficiency of the stoker and conserves fuel. When the stoker is firing continuously due to the Sensatherm calling for heat, the stack temperature continues to increase. After a certain temperature is reached, the boiler is operating at its maximum capacity and further firing only increases the stack temperature. The Mercoid control (No. 2) limits the stack temperature by stopping the stoker and thus conserves fuel. When the stack temperature lowers sufficiently the Mercoid control again starts the stoker and this operation is repeated until the Sensatherm opens its circuit.

Defendant's Exhibit O

BULLETIN No. 241

# MERCOID STOKATHERM CONTROL SYSTEM

REGISTERED TRADE MARK

LISTED AS STANDARD BY UNDERWRITERS' LABORATORIES, INC.

TYPE TJ-V STOKATHERM

TYPE M-11 PYRATHERM

## A NEW STOKER CONTROL SYSTEM

### *Incorporating the following important features:*

**FIRE MAINTAINING**

The Stokatherm System operates the stoker for only the very shortest periods necessary to maintain a minimum fire while the thermostat is in the off-position.

The firing periods are not at definitely timed intervals or governed by fixed stack temperatures, but are automatically regulated to meet the variable conditions encountered on each installation. As domestic stokers operate approximately 80% of the heating season on the fire maintaining controls, the economical, short operations of the Stokatherm not only result in a very decided fuel saving, but also insure against overheating.

**AUTOMATIC COMPENSATION FOR VARIATIONS IN FUEL**

If the fuel delivered to the stoker should have a higher or lower burning rate than that formerly used, the Stokatherm System automatically compensates for this and changes its firing period accordingly. This eliminates service due to overheating or out-fire.

**OUT-FIRE OPERATION**

Should the fuel become exhausted, or the fire go out, the Stokatherm System automatically stops the stoker. This prevents operating an empty stoker and guards against filling the combustion chamber with unburned fuels, a condition most unpleasant to the operator.

**RUGGED CONSTRUCTION, EASY TO INSTALL.**
**LOWER SERVICE EXPENSE TO THE DEALER.**
**INCREASED ECONOMY TO THE USER.**

LIST PRICES

TYPE TJ-V STOKATHERM, 110 OR 220 VOLT, 60 CYCLE $32.50 TYPE M-11 PYRATHERM $12.50

**THE MERCOID CORPORATION**
SOLE MANUFACTURERS OF THE MERCOID SWITCH
4901 BELMONT AVENUE • CHICAGO, ILLINOIS, U. S. A.

# MERCOID STOKATHERM

## STOKER CONTROL PROGRESS

For many years manually controlled chain grate or underfeed stokers were employed on industrial installations. As underfeed stokers were developed in smaller sizes to meet the requirements for industrial and commercial steam heating equipment, there was an increasing demand for controls to eliminate a great amount of the manual attention required, by automatically controlling the steam pressure. This demand was easily met by the adaptation of standard pressure limit controls.

During the past few years small size stokers for domestic heating plants have been introduced and accepted in ever increasing volume. To meet the competition of other automatic heating equipment it was necessary to provide thermostatic room temperature regulation. A new problem arose as it became necessary to provide means to keep the fire from going out during the long periods, especially in mild weather, when heat is not required but the thermostat remains in the off position. Controls were not available which had been designed especially to meet the many variable conditions encountered on domestic stoker installations. As a result it was necessary, at the time, to employ standard controls, developed for other applications, and modify them in the best possible manner to meet stoker requirements. Two methods were adopted, one operating the stoker at definitely timed intervals, and the other at fixed stack temperatures or boiler water temperatures.

Timers with or without a delay after the thermostat is satisfied, fire the stoker at fixed intervals for a predetermined period. In mild weather, when for prolonged periods the thermostat does not call for heat, timers must be set to operate long enough to feed a sufficient amount of fuel to maintain combustion. During colder seasonal periods when the thermostat operates at short intervals this amount is greatly in excess of the quantity required merely to maintain combustion, and is likely to cause overheating and a consequent waste of fuel. The operating period of the timer can be decreased to meet this condition and prevent overheating, however, when mild weather again prevails, the fire may then go out due to the fire maintaining period being too short. This seasonal changing of the timer setting results in unnecessary service expense. Furthermore, ordinary types of timers employ no outfire feature or protection against the stoker's operating without fuel, or filling the combustion chamber with unburned fuel, either of which is a most annoying and undesirable condition.

The other method of controlling stoker operation has been through the use of a stack control, which stops and starts the stoker at predetermined low stack temperatures. A somewhat similar method has been used on steam boilers, whereby the periods of operation of the stoker are determined through the temperature of the boiler water instead of through the temperature of the flue gases. As this method was adaptable only on steam installations, the stack type control became more popular. Stack controls usually employ metal elements which expand and contract with stack temperature changes and actuate the controls. It sometimes happens that these actuating elements are subjected to excessive temperatures and corrosive flue gases. Under such abnormal conditions these elements are apt to change and take a set or what is known as a metal "growth." This changes the original calibration of the control and results in overheating, consequent waste of fuel, and the expense of servicing to recalibrate the control.

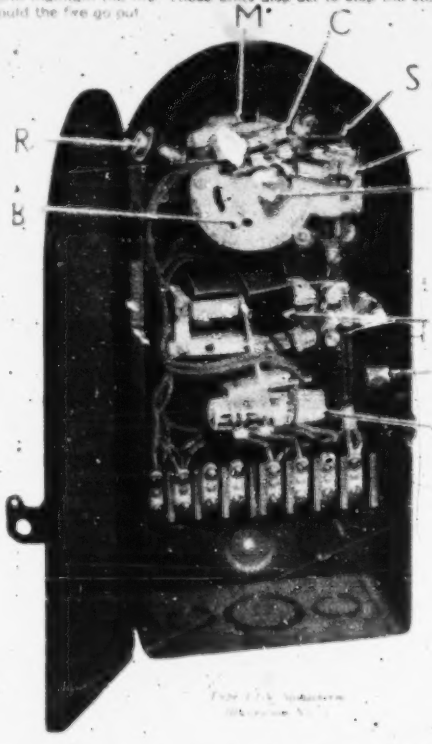
Several years' intensive study of the needs of the stoker field has resulted in the development of a control system that fully meets all requirements. The MERCOID STOKATHERM SYSTEM is based on a new principle of operation effectively combines the advantages of Timer and Stack Controls, and at the same time overcomes the former weaknesses and disadvantages of those devices.

It is important that fire be maintained during the periods when the thermostat does not call for heat. Further, it is important that during this period the fire be maintained economically, so that excessive amounts of fuel are not consumed when heat is not required.

The Stokatherm system operates the stoker for only the shortest periods necessary to maintain a minimum fire while the thermostat is in the "off" position. The firing periods are not at definitely timed intervals or governed by fixed stack temperatures, but are automatically regulated to meet the variable conditions encountered on each installation. During approximately 80 per cent of the heating season stokers operate on the fire maintaining controls. The economical, short operations of the Stokatherm not only result in a very decided fuel saving, but also assure against overheating. Should the fuel delivered to the stoker have a higher or lower burning rate than that formerly used, the Stokatherm system automatically compensates. It thus automatically changes its firing period accordingly. Should the fuel become exhausted or the fire go out, the Stokatherm system automatically stops the stoker. This prevents running the stoker unnecessarily, and guards against filling the combustion chamber with unburned fuel.

## CONSTRUCTION DETAILS OF STOKATHERM

The Mercoid Stokatherm System consists of several units operating in conjunction. The Sensatherm and boiler limit control are in command of the stoker's operation when heat is required. When heat is not required the Stokatherm and Pyratherm maintain the fire. These units also act to stop the stoker should the fire go out.




**TIMER**—The timer is actuated by a positive self-starting Waltham synchronous motor movement of the highest quality, with heavy cut brass wheels having pinions of hardened and polished tool steel.

**MERCOID TRANSFORMER RELAY**—The Mercoid Transformer-Relay incorporated in this control is a very simple and compact device which is in principle a low voltage transformer but also operates as a repulsion-relay.

Two independent insulated coils are mounted on a laminated iron yoke. The primary coil is fixed in position and is connected across the high voltage line. The secondary coil is movable and is connected to the low voltage thermostat circuit. These two coils act as a transformer and low voltage is induced in the secondary coil when the primary coil is energized. When the low voltage thermostat circuit is closed, the secondary coil instantly moves to the right, due to the repulsion action of the coils, and starts the stoker by closing the motor switch circuit "D."

As this transformer relay does not employ the conventional clapper type iron armature, rattling noises due to uneven fluxes or dusty armature faces cannot occur. Furthermore, there can be no residual magnetism to affect the operation as there are no metal contacting surfaces.

**MERCOID MERCURY SWITCHES**—Mercoid mercury contact switches are used throughout. These switches with their hermetically sealed mercury contacts are immune to oxidation, dirt, or corrosion. Burning, pitting and sticking, sources of service trouble and expense with open-to-air contacts, cannot occur with the sealed Mercoid switch. The contact remains

# CONTROL SYSTEM FOR

permanently clean and the free flowing mercury insures perfect electrical contact at every operation.

**STEEL HOUSING**—The steel housing has an attractive black crystal finish. It has a gasketed dust-tight hinged cover, with door opener which can be sealed or padlocked. Back of case has three embossings: one with regular hole, and two with bayonet slots, to simplify installation. Three screws are provided for fastening to wall.

Height 12 in., Width 6 1/2 in., Depth 3 3/4 in. Shipping weight approximately 10 pounds.

**SIMPLIFIED WIRING**—Knockouts are provided on back, bottom and both sides of the case, for BX or conduit wiring. Terminal posts are accessible and ample room is provided for wiring.

**ADJUSTMENTS**—Adjustments are provided to meet variations in the operating characteristics of different types of stokers. When the proper adjustments have been determined for a particular type of stoker, these same adjustments can be employed on all installations whether steam, hot water or warm air. Only if conditions are very abnormal is a change in adjustment required on any installation.

When the thermostat is satisfied and the stoker stops, the stack temperature gradually drops, and in response to this decrease in stack temperature, the M-11 Pyratherm (explained below) closes its circuit. This energizes both timing motor "M" and solenoid "S" in the Type TJ-V unit.

When solenoid "S" is energized, its plunger rises and engages the front gear mechanism with the motor movement. After the time as set by the FIRE MAINTAINING ADJUSTMENT "B" has elapsed, circuit "F" closes and operates relay "T" which starts the stoker. As soon as the fire responds, causing a slight increase in stack temperature, the Pyratherm opens the circuit to the timing motor and stops the stoker.

Should the fire be out, the stack temperature does not rise to open the Pyratherm circuit. The stoker then continues to operate for the period set by the OUT-FIRE ADJUSTMENT "E". At the end of this period switch "C" opens its circuit and stops the stoker.

**TYPE M-11 PYRATHERM**

Type M-11 Pyratherm
(Illustration No. 4)

The M-11 Pyratherm is radically different from conventional stoker stack controls, as it does not operate at pre-determined high and low temperature settings, but operates only on a differential or change in temperature.

On an increase in temperature, the circuit immediately opens, regardless of the temperature existing in the stack at the time. Regardless of how high the temperature may continue to rise, the unique Mercoid ratchet assembly provided permits the bimetal coil to turn without strain.

On a decrease in temperature, the circuit immediately closes, regardless of the temperature existing in the stack at the time. The ratchet assembly again relieves the bimetal coil from strain regardless of how low the temperature may go.

This instrument, operating by means of the ratchet assembly on a differential in temperature, differs from conventional stoker stack controls, in that it remains in perfect adjustment, regardless of changes in "sets" in the bimetal coil due to excessive temperatures or corrosive flue gases. For this reason, no protecting well is required over the bimetal coil.

**OPERATION OF STOKATHERM SYSTEM**—In order to clarify the description of the operation of the Mercoid Stokatherm Control System, we are assuming normal conditions as encountered in the average domestic stoker burning a fair grade of bituminous coal. Under such conditions, the normal setting of the fire maintaining adjustment "B" is 30 minutes and the out-fire adjustment "E" is 30 minutes. For large domestic or industrial stokers, these adjustments must necessarily be changed, as covered in a later paragraph under heading "Operating Instructions."

**NORMAL OPERATION. — SENSATHERM CALLING FOR HEAT**—When the Sensatherm calls for heat the relay "T" operates and closes switch circuit "D" which in turn causes the stoker motor to operate. As the fire builds up the stack temperature continues to rise. The maximum stack temperature attained varies on different installations as it is dependent upon the feeding rate of the stoker, the construction of the boiler, and the period of time the stoker continues to operate. As soon as the stack temperature starts rising the M-11 Pyratherm opens its circuit. The bimetal coil continues to turn until the maximum stack temperature is reached. No strain is placed on this coil as the temperature continues to rise, as the gravity locking mechanism of this instrument permits free movement through a toothed ratchet wheel. When the maximum stack temperature has been attained, there is no further movement of the bimetal coil and the switch circuit remains in the open position as long as the thermostat continues to call for heat.

**FIRE MAINTAINING — SENSATHERM CIRCUIT OPEN**

When the Sensatherm opens its circuit due to the room's being at the required temperature, the Mercoid Relay "T" instantly opens its circuit and stops the stoker. The fire now starts dying down and the stack temperature decreases accordingly. As this decrease in stack temperature occurs, the bimetal coil of the M-11 Pyratherm starts turning and the first movement causes the switch circuit to close. The closing of this circuit energizes motor "M" and solenoid "S." The Stokatherm timing motor is now in operation and within the period as set by adjustment "B" which we have assumed at 30 minutes, switch "F" closes its circuit and operates the relay, which, in turn, again starts the stoker.

UNDER NO CIRCUMSTANCES CAN THE STOKER OPERATE IN LESS THAN 30 MINUTES AFTER THE THERMOSTAT SHUTS OFF. DURING THIS 30 MINUTE DELAY PERIOD, THE STACK TEMPERATURE CONTINUES TO DECREASE. On the average installation the stack temperature drops several hundred degrees during this first thirty minute period, and the Pyratherm accordingly follows this change. Regardless of how low the temperature may drop, only a slight rise in stack temperature is necessary to open the Pyratherm circuit.

If the fire is in good condition, as is normally the case during the first fire maintaining operation after the thermostat shuts off, the stoker operates for only a very short period, usually from 10 to 15 seconds, until the stack temperature rises and opens the Pyratherm circuit, which immediately stops the stoker. As the Pyratherm circuit opens, timer motor "M" stops, and as solenoid "S" is deenergized the movement gear train releases and immediately returns to its normal starting position.

As the stoker is now not operating, the stack temperature starts decreasing and the M-11 Pyratherm accordingly again closes its circuit. This causes the Stokatherm mechanism to start operating and another test of the condition of the fire will again be made when another thirty minute delay period has elapsed. During this thirty minute period, the fire continues to die down and the stack temperature lowers accordingly. As soon as the Stokatherm starts the stoker, the M-11 Pyratherm performs its most important function in maintaining a low and even fire bed. THE CONDITION OF THE STOKER FIRE IS ACCURATELY INDICATED BY THE RATE AT WHICH THE STACK TEMPERATURE RISES AS THE STOKER BLOWER STARTS OPERATING. If a fast burning coal has been employed the fire may now be very low. Regardless of the condition of the fire, the M-11 Pyratherm permits the stoker to operate only until there is a response from the fire as is indicated by the rise in stack temperature. If the fire is in good condition, the period of operation will be very short—10 or 20 seconds—but should the fire be low the period of operation is increased accordingly until the fire responds and the stack temperature rises.

The M-11 Pyratherm continues periodically to check the condition of the fire as above outlined, until the fire reaches the lowest point at which combustion can be sustained. Operation at this low point now continues with the stoker using a minimum amount of fuel, until the thermostat again calls for heat. This system is so sensitive while maintaining a minimum fire that it automatically compensates even for changes in basement air temperature or boiler water temperature. The stack temperatures may fluctuate considerably during such changes, but only sufficient fuel is fed to maintain a minimum fire.

The firing periods are not at definitely timed intervals or at fixed stack temperatures, as this control system automatically regulates the firing periods to meet the variable conditions encountered on each installation. The stoker operates for only the very shortest periods necessary to maintain the fire during the time the thermostat is in the off position. This not only results in a very decided saving in fuel, but also insures against overheating. The feature of automatically compensating for the warm

# AUTOMATIC STOKERS

ables encountered on each installation eliminates unnecessary servicing. If a new supply of fuel delivered to the stoker has a faster or slower burning rate than that previously used, the Stokatherm system, being directly responsive to the condition of the fire, automatically varies the amount of fuel supplied accordingly. This eliminates servicing due to overheating or out-fire.

**OUT-FIRE OPERATION—FIRE EXTINGUISHED**—Should the fuel become exhausted, or the fire go out, the stack temperature lowers, causing Pyratherm M-11 to close its circuit and actuate the Stokatherm mechanism. Even though the thermostat is in the "on" position calling for heat, the Stokatherm mechanism operates, and when the out-fire period governed by adjustment "E" has expired (normal setting 30 minutes), switch "C" opens its circuit and stops the stoker. When the fire has been rekindled the stoker may again be started by pressing hand reset button "R".

**AUTOMATIC RESET OF STOKATHERM MECHANISM**
When the Sensatherm calls for heat, it immediately takes command and operates the stoker. At this time the Stokatherm mechanism may be at any point in its cycle of maintaining the fire. The Stokatherm mechanism, however, does not stop at any intermediate point in its cycle, but is automatically reset to the normal starting position by the Pyratherm. This insures satisfactory operation as the Stokatherm then goes through its complete cycle the next time this instrument is called upon to operate.

Automatic reset of the Stokatherm mechanism is accomplished through the rise in stack temperature which follows after the Sensatherm places the stoker in operation. The Pyratherm responds to this rise in stack temperature and opens its circuit. As this circuit opens, timer motor "M" stops, and as solenoid "S" is deenergized the movement gear train releases and immediately returns to its normal starting position.

## Additional Controls Required to Complete the Mercoid Stokatherm System

The Mercoid Stokatherm and Pyratherm make up only part of a complete Stokatherm system. Satisfactory operation can be assured only when the system is completed by the use of the Mercoid Sensatherm and Mercoid limit controls. These instruments have operating characteristics which coordinate with the operation of the Stokatherm and provide assurance of positive and satisfactory stoker performance.

All switches in Mercoid controls are of the hermetically sealed mercury contact type. They cannot be affected by dust, dirt, or corrosive gases. The contacting surfaces remain clean under all operating conditions.

### MERCOID SENSATHERM

The Mercoid Sensatherm is a thermostat of beauty and mechanical perfection. It is extremely sensitive and maintains a uniform room temperature without the use of any artificial stimulation. It operates on a differential of one degree (plus or minus ½ degree) and is adjustable to meet special requirements.

Dual Sensatherms are also available for day and night temperature regulation. When employed with the Mercoid-Triplex electric time switch, no winding or attention whatsoever is required in changing from day to night setting.

Write for bulletin No. 100A.

### MERCOID TYPE DA-31 STEAM CONTROLS

Mercoid Type DA-31 steam controls are furnished with convenient outside double adjustments for independently setting the cut-in and cut-out pressures. They are equipped with a visible and accurately calibrated dial. No calculations are necessary to determine the operating points, the indicators accurately show on the dial the pressures at which the instrument is set to operate. Very close differentials can be obtained, and wide range adjustments are provided. Sealing or locking means provided as standard to prevent tampering.

Available in ranges from 30" vacuum to 300 lbs. pressure.
Write for bulletin No. C-65.

### WARM AIR FURNACE CONTROLS

The Mercoid Type M-51 control is used to protect warm air furnaces against over-heating. It has a dial calibrated from 50 to 650 deg. F. Double adjustments are provided for easily setting both the cut-in and cut-out temperatures. An indicator shows the temperature in the furnace bood.

Type M-53 is similar in construction to Type M-51. It is used to control the operation of warm air furnace circulating fans.

### HOT WATER BOILER CONTROLS

#### Immersion Type Control

These Controls have proven their unfailing accuracy and durability over years of service, to be the correct type of automatic limiting device for coal stokers operating on hot water boilers and vapor-vacuum systems. There is no lag in the operation as is encountered with controls mounted on the outside of boiler or risers.

Type DA-36 has the same outside adjustments as described under DA-31. No other control provides such desirable features for control of hot water boilers, hot water storage tanks, indirect water heaters on steam boilers or close pressure regulation of vapor-vacuum systems. Both straight and bank angle types are available. Write for bulletin No. C-65.

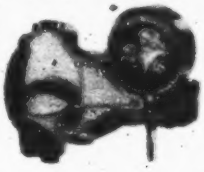
#### Surface Type Control

Where circumstances require temperature control by surface contact, the Fig. 35 Mercoid Risertherm is recommended. This limiting control is clamped on the risers of hot water heating systems or on the surface of hot water tanks. It is especially recommended for old jobs where it would be difficult to remove the boiler plug for installation of the immersion type control.

This instrument employs features which make it positive in action and very sensitive to temperature changes.

Write for bulletin No. 220-A.

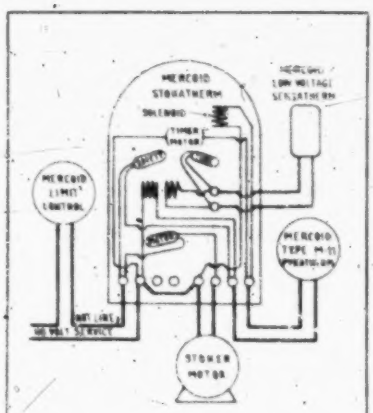
### MERCOID COMBINED PRESSURE AND LOW WATER CONTROL TYPE DA-71



This control has the new double adjustment feature. It is designed primarily for the protection of automatically fired steam boilers, to prevent the hazard of firing into dry boilers and also guard against building up excess steam pressure. This Bourdon tube equipped control has proven its efficiency and durability on thousands of installations. Ranges are available up to 300 pounds.

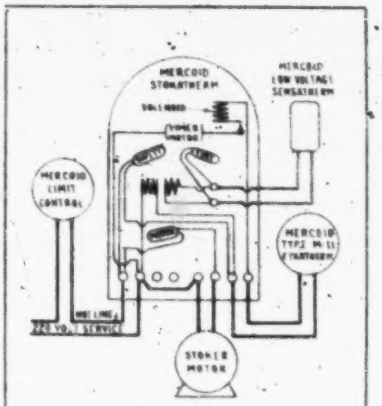
Write for bulletin No. C-68.

# WIRING DIAGRAMS



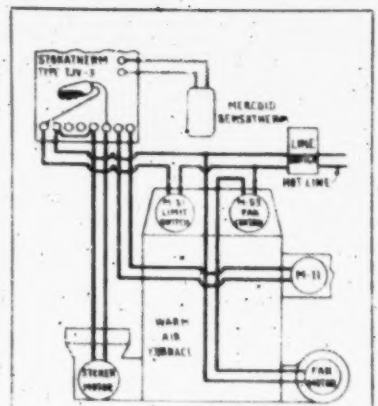

STOKATHERM CONTROL WIRING FOR SINGLE PHASE 110 VOLT MOTORS

No. 7



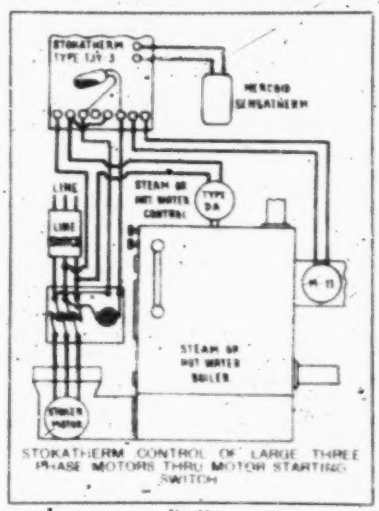

STOKATHERM CONTROL WIRING FOR SINGLE PHASE 220 VOLT MOTORS

No. 8



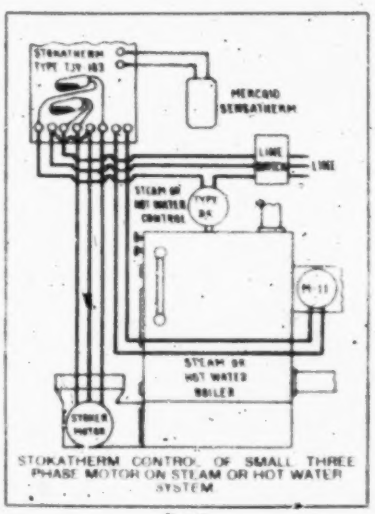

STOKATHERM CONTROL OF SINGLE PHASE MOTOR AND CIRCULATING FAN ON WARM AIR SYSTEM

No. 9



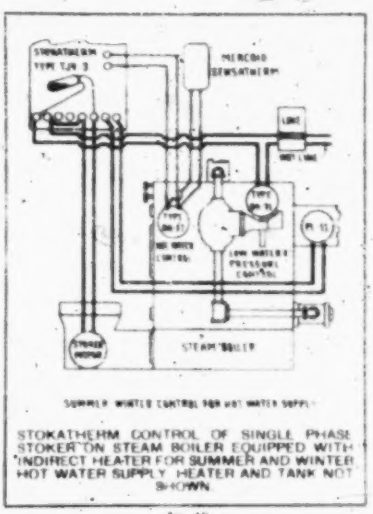

STOKATHERM CONTROL OF LARGE THREE PHASE MOTORS THRU MOTOR STARTING SWITCH

No. 10




STOKATHERM CONTROL OF SMALL THREE PHASE MOTOR ON STEAM OR HOT WATER SYSTEM

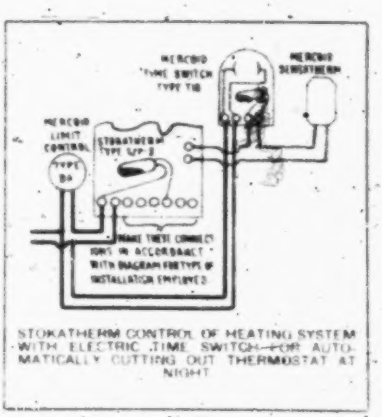
No. 11




SUMMER WINTER CONTROL FOR HOT WATER SUPPLY

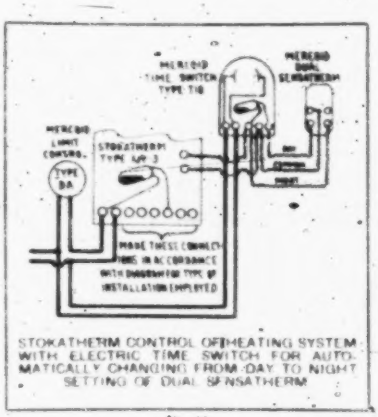
STOKATHERM CONTROL OF SINGLE PHASE STOKER ON STEAM BOILER EQUIPPED WITH INDIRECT HEATER FOR SUMMER AND WINTER HOT WATER SUPPLY. HEATER AND TANK NOT SHOWN.

No. 12



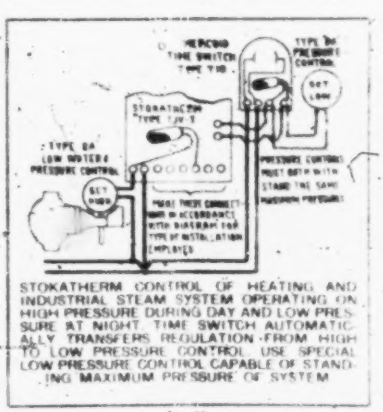

STOKATHERM CONTROL OF HEATING SYSTEM WITH ELECTRIC TIME SWITCH FOR AUTOMATICALLY CUTTING OUT THERMOSTAT AT NIGHT

No. 13




STOKATHERM CONTROL OF HEATING SYSTEM WITH ELECTRIC TIME SWITCH FOR AUTOMATICALLY CHANGING FROM DAY TO NIGHT SETTING OF DUAL SENSATHERM

No. 14




STOKATHERM CONTROL OF HEATING AND INDUSTRIAL STEAM SYSTEM OPERATING ON HIGH PRESSURE DURING DAY AND LOW PRESSURE AT NIGHT. TIME SWITCH AUTOMATICALLY TRANSFERS REGULATION FROM HIGH TO LOW PRESSURE CONTROL. USE SPECIAL LOW PRESSURE CONTROL CAPABLE OF STANDING MAXIMUM PRESSURE OF SYSTEM.

No. 15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# INSTALLATION INSTRUCTIONS

**INSTALLING TYPE TJ-V STOKATHERM**—Carefully select an accessible and firm location in the vicinity of the stoker, preferably on a wall or column free from vibration.

Place the control at the location desired and with a pencil circle the three mounting holes. The top two holes have bayonet slots to simplify mounting. Remove the control and install the top two screws, but do not draw up tight. Hang the control on the top two screws, and after LEVELING install the bottom screw and tighten the top screws.

**INSTALLING TYPE M-11 PYRATHERM**—Choose the location with care. The usual location is about two feet from the furnace, on the most convenient side of the stack.

Cut a 1¼" hole directly on the side of the stack so that the instrument stem is horizontal when mounted. Fasten the flange around the hole and insert the stem so that the BODY OF THE INSTRUMENT IS AS FAR AS POSSIBLE FROM THE STACK TO PREVENT EXCESSIVE HEAT.

BE SURE THE INSTRUMENT IS LEVEL, before tightening the flange set screw. This can be determined by sighting across cover screws, seeing that they are horizontal.

**WIRING**—Check nameplate on Stokatherm and see that cycle and voltage correspond with the current used. Be sure the connected load is within the motor rating of the control. Wire in accordance with diagrams in the cover, or if special hook-ups are desired, then in accordance with diagrams shown on page to right.

Do not attempt to make any external transformer connections in the Sensatherm circuit as the Mercoid Transformer Relay induces its own low voltage.

If large stoker motors requiring starting switches are used; the STOKATHERM may be used to control the pilot circuit of the starting switch. See cover diagram No. 21 or 23. When connected in the pilot circuit, the motor switch terminal having the red tipped end must be removed from terminal post No. 1 and connected to terminal post No. 3.

RIGID CONDUIT MUST NOT BE ATTACHED DIRECTLY TO PYRATHERM OR BOILER-LIMIT CONTROLS. Use a short strip (6 or 8 in.) of BX cable between control and conduit. If rigid conduit connections are made, expansion and contraction strains are very apt to break control connection at boiler.

Careless terminal connections are often responsible for service trouble. Scrape and clean wire and carefully place around terminal screw in the direction the screw turns. (See illustration No. 5.)

Illustration No. 5

Use two-wire armored low voltage cable between the Mercoid Sensatherm and the thermostat terminals of the relay. Bring the low voltage cable through the brass bushing "G". (See illustration No. 3) and securely attach wires to the terminals marked "Thermostat." Pull out excess cable and firmly clamp cable in bushing "G" by means of screw provided.

## OPERATING INSTRUCTIONS

If stoker has stopped due to fire's going out, rekindle fuel and start stoker by pushing the reset button "R". (Illustration No. 6. If fire has gone out while fuel still remains in the hopper, it may be necessary to change adjustment "B" to a shorter period.

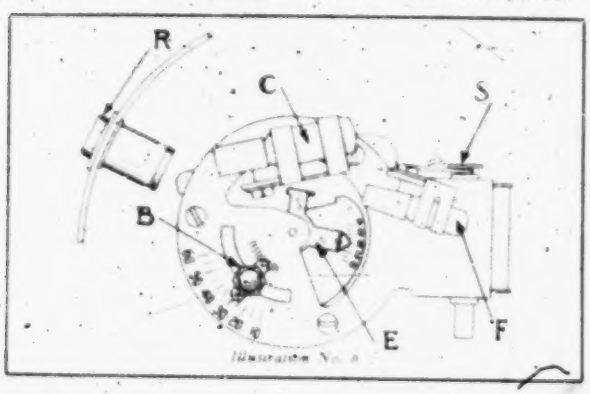



Illustration No. 6

A normal adjustment of "B" is 30 minutes as set at the factory. This adjustment is usually satisfactory, unless a fast burning coal such as Lignite, is used for which a shorter adjustment may be needed. On heavy coals a longer adjustment should be used to obtain the greatest economy. Excessive fire box temperatures during long periods of maintaining fire, as in mild weather, indicate that adjustment "B" is too short, and the period should be increased.

Out-fire adjustment "E" is set at the factory for 30 minutes, and need not be decreased unless a very high rate of fuel feeding is used, in the stoker installation. The adjustment limits the amount of unburned fuel that can be conveyed into the combustion space, or the period of time the stoker can operate without fuel.

**When adjustments are made power supply must be "off".**

## NOTES FOR SERVICE MEN

1. Tube "C" is outfire switch.
2. Tube "F" is fire-maintaining switch.
3. Tube "D" is motor switch.
4. The complete Stokatherm System is inoperative when tube "C" is in the off position. This would occur if the fuel should become exhausted. It may also occur due to adjustment "B" being set at too wide an interval, in which case the adjustment must be shortened.
5. Tube "F" is in parallel with thermostat. When in the on position the stoker operates. This switch is operated only by the timer motor.
6. The tube in the M-11 Pyratherm must be in the "on" position for timer to run. This tube will assume its proper position when the fire is kindled.
7. No adjustments are required on the M-11 Pyratherm.
8. The timer motor does not run during the period that the thermostat calls for heat and normally operates the stoker.
9. When timer mofor is running, plunger "S" is in the up position. When timer motor is not energized, plunger "S" is in the down position.
10. When the thermostat calls for heat it immediately takes command of the stoker operation. The timer mechanism continues its cycle of operation only until the Pyratherm circuit opens.
11. The timing mechanism always returns to the starting position, on a current interruption, or on a rise in stack temperature sufficient to move the tube in the stack control to the open position.
12. Operation of the timer can be tested without waiting for the entire Fire Maintaining Period to elapse. This can be accomplished by lifting up on adjustment "E" until switch "F" almost makes contact. The timing mechanism in completing the cycle will close this circuit. In making this test the power must be on, the thermostat must be in the "off" position, and the Pyratherm tube and outfire tube "C" must be in the closed position. DO NOT ATTEMPT TO OPEN TUBE CIRCUIT "F", by pushing downward on this tube or by pushing down on adjustment "E", as in either case the mechanism may be strained. To open tube circuit "F", push down on plunger "S" or interrupt power supply.

## CAUTION

HAVE YOU READ DESCRIPTION OF OPERATION AND INSTRUCTIONS CAREFULLY?

KEEP INSTRUMENT COVERS CLOSED.

DO NOT OIL ANY PARTS.

DO NOT OVERLOAD—See rating on nameplate.

DO NOT ATTEMPT TO DISCONNECT OR CHANGE ANY PARTS.

# MERCOID
## AUTOMATIC CONTROLS

FOR HEATING, AIR CONDITIONING, REFRIGERATION
AND VARIOUS TYPES OF INDUSTRIAL APPLICATIONS

**Defendant's Exhibit Q**

**CATALOG NUMBER 400**

PRICES EFFECTIVE FEBRUARY 1, 1940
Subject to Change Without Notice

CABLE ADDRESS: MERCOID CHICAGO
CODE: ABC FIVE LETTER FIFTH EDITION

THE MERCOID CORPORATION
MAIN OFFICE AND FACTORY • 4201 BELMONT AVE. • CHICAGO, ILL. U.S.A.
NEW YORK OFFICE 330 W. 34th ST. • PHILADELPHIA OFFICE 3137 N. BROAD ST. • BOSTON OFFICE 839 BEACON ST.
Sole Manufacturers of The Mercoid Switch

# WARM AIR FURNACE CONTROLS

EQUIPPED WITH THE MERCOID SEALED MERCURY CONTACT SWITCH

TYPE M-51

TYPE M-51SW

## TYPE M-51 MERCOID WARM AIR LIMIT CONTROLS

The Mercoid Warm Air Limit Control is neat in appearance and is sturdily constructed thruout to render long and dependable service in the field. Its use is recommended on all furnace installations to prevent overheating.

The Mercoid switch is of the enclosed mercury contact type. It is not subject to open arcing, corrosion, oxidation, or pitting and will operate indefinitely without deterioration. The mechanism of this control has many outstanding features. The dial, located in the center of the instrument, slowly rotates as the temperature on the bi-metal coil increases or decreases. This dial is clearly calibrated in degrees Fahrenheit, and a pointer indicates the temperature in the furnace or duct,—enabling the installation or service men to check the proper size of fire.

A simple double adjustment is provided for setting both the "high" and "low" operating points. The range can be adjusted over the entire scale, and the differential can be set for very close operation, or may be widened to meet any field requirements.

The flange provided permits mounting of this control on any furnace hood, as it is adjustable for any angle between 30 and 90 degrees. Easily installed by means of the four sheet metal screws provided.

### SPECIFICATIONS

**TYPE M-51**: Available in standard ranges 25 to 300°F., 50 to 500°F., or 50 to 650°F. Recommended as limit control on installations where minimum temperature codes are not in effect. Single pole—circuit opens on rise in temperature.

**TYPE M-51D**: Recommended where local code requirements or The National Board of Fire Prevention specifications are enforced. Range adjustable 25 to 200°F. Single pole—circuit opens on rise in temperature.

**TYPE M-51G**: Complies with A.G.A. ruling limiting operating temperatures of warm air furnaces. Range adjustable 25 to 250°F. Single pole—circuit opens on rise in temperature.

**AIR CONDITIONING TYPES**: Where an air conditioning installation must conform to National Board of Fire Underwriters' regulations (Rule 172 pamphlet 90) for the prevention of propagation of fire thru ducts passing thru fire walls, refer to Types M-51S, and M-51R (page 23) which have been especially designed for this service.

**TYPE M-52L**: Two circuit low voltage—one circuit opens as other circuit closes. Recommended for use with 3 wire damper motors or other series "20" equipment. Capacity 4 amp., 25 volt. Standard range 80 to 500°F.

**ELECTRICAL CAPACITY**: Standard single pole instruments 10 amp.-115V., 5 amp.-230V. Not available for 440V.

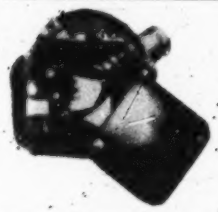
**MOTOR RATING**: 1 H.P. Repulsion-Induction, ½ H.P. Split-Phase or D.C.

**SPECIAL CIRCUITS**: Available double pole or two circuit—see page 58 for ordering data and addition to list price.

| TYPE NO. | RANGE ADJ. | CODE | LIST PRICE |
|---|---|---|---|
| M-51 | 25-300° F. | utoow | $7.00 |
| M-51 | 50-500° F. | utogs | 7.00 |
| M-51 | 50-650° F. | uvkei | 7.00 |
| M-51D | 50-200° F. | utoqy | 7.00 |
| M-51G | 25-250° F. | uvoip | 7.00 |
| M-52L | 50-500° F. | utosa | 8.00 |

With Centigrade graduations—
Code "utsin" No extra charge

Shipping weight approx. 5 lbs.



## TYPE 116 MERCOID DUCTATHERM

### LOW VOLTAGE WARM AIR LIMIT CONTROL

Type 116 Mercoid Ductatherm is recommended as a limit control for warm air systems, where the equipment controlled is of the low voltage type such as damper motors or gas valves.

The Ductatherm has an external dial calibrated from 50 to 300°F. To set the operating range it is merely necessary to move the external adjustment pointer to the required temperature.

The wiring is simplified as three terminals are provided as well as two low voltage cable bushings. Either series or multiple hook-ups can be made without splicing any connections.

Furnished standard with 9 inch extension sleeve. Available on special order (no extra charge) with 4½ inch sleeve length. Available only with flat mounting flange.

**ELECTRICAL CAPACITY**: Low Voltage—0/10th amp., 24 volt.

| TYPE NO. | RANGE ADJ. | CODE | LIST PRICE |
|---|---|---|---|
| 116 | 50-300° F. | utozh | $ 7.00 |

For Centigrade graduations—
Code "utsin" No extra charge

Shipping weight approx. 3 lbs.

## TYPE M-53SW MERCOID WARM AIR FAN CONTROL

### FURNISHED STANDARD WITH SUMMER SWITCH

The Mercoid Warm Air Fan Control is neat in appearance and is sturdily constructed thruout to render long and dependable service in the field. Its use is recommended to control the operation of air-circulating or booster fans. This instrument operates the fan economically and prevents blowing cold air into the room if furnace is not hot enough to deliver heat.

All Type M-53SW Controls are furnished standard with lock type manual switch button. Turning button locks fan switch in "on" position and permits operation of fan during summer months for ventilating purposes. When furnace is again fired and temperature rises, manual switch automatically unlatches and restores control to normal operation.

The Mercoid switch is of the enclosed mercury contact type. It is not subject to open arcing, corrosion, oxidation, or pitting and will operate indefinitely without deterioration. The mechanism of this control has many outstanding features. The dial, located in the center of the instrument, slowly rotates as the temperature on the bi-metal coil increases or decreases. This dial is clearly calibrated in degrees Fahrenheit, and a pointer indicates the temperature in the furnace or duct,—enabling the installation or service men to check the fan operation.

A simple double adjustment is provided for setting both the "high" and "low" operating points. The range can be adjusted over the entire scale, and the differential can be set for very close operation, or may be widened to meet any field requirements.

The flange provided permits mounting of this control on any furnace hood, as it is adjustable for any angle between 30 and 90 degrees. Easily installed by means of the four sheet metal screws provided.

### SPECIFICATIONS

**TYPE M-53SW**: Standard ranges 25 to 300°F., or 50 to 500°F. Circuit closes as temperature rises. Recommended for installations where minimum temperature codes are not in effect.

**TYPE M-53SWD**: Recommended where local code requirements or The National Board of Fire Prevention specifications are enforced. Range adjustable 25 to 175°F. Circuit closes as temperature rises.

**TYPE M-53SWG**: Complies with A.G.A. ruling limiting the operating temperatures of warm air fans. Range adjustable 25 to 200°F. Single pole—circuit closes on rise in temperature.

**ELECTRICAL CAPACITY**: Standard single pole instruments, 10 amp.-115V., 5 amp.-230V. either A.C. or D.C. Not available for 440V.

**MOTOR RATING**: 1 H.P. Repulsion-Induction, ½ H.P. Split Phase or D.C.

**SPECIAL CIRCUITS**: Available double pole or two circuit—see page 58 for ordering data and addition to list price.

| TYPE NO. | RANGE ADJ. | CODE | LIST PRICE |
|---|---|---|---|
| M-53SW | 25-300° F. | utowe | $7.00 |
| M-53SW | 50-500° F. | utoxf | 7.00 |
| M-53SWD | 25-175° F. | utnyg | 7.00 |
| M-53SWG | 25-200° F. | uvokq | 7.00 |

With Centigrade graduations—
Code "utsin" No extra charge

Shipping weight approx. 5 lbs.

# TEMPERATURE LIMIT CONTROLS • DIRECT-CONNECTED TYPE

EQUIPPED WITH THE MERCOID SEALED MERCURY CONTACT SWITCH

TYPE DA-36 STRAIGHT STEM

TYPE DA-37 BACK ANGLE STEM

## TYPES DA-36 AND DA-37 IMMERSION CONTROLS

**With Double Outside Adjustments and Accurately Calibrated Visible Dial**

No other control provides such desirable features for control of hot water boilers, hot water storage tanks, or for industrial applications where positive liquid temperature regulation is required.

Mercoid Immersion Controls are accurate in performance and dependable after years of service. There is no lag in their operation such as is encountered with controls mounted on the outside of boilers or risers. The copper bulb is installed directly in the boiler water and the volatile liquid within quickly follows changes in the boiler water temperature.

The Mercoid Types DA-36 and DA-37 controls retain those reliable features of former immersion controls but eliminate the expense and inconvenience of checking the control operation against boiler thermometers. No guesswork or tests are now required. Close differentials are obtainable where desired, and the indicators show at a glance the temperatures at which the instrument operates.

The immersion bulbs are 3 in. long and have ½ in. I.P.S. connection. Bulbs 1¼ in. long with ¾ in. connection can be supplied on special order at no extra charge.

### RANGES AND DIFFERENTIALS

| RANGE NUMBER | ADJUSTABLE OPERATING RANGE | DIFFERENTIAL WHEN OPERATING POINT SET AT | | | MAX. DIFF. | MAXIMUM TEMPERATURE WHICH MAY NOT EXCEED |
|---|---|---|---|---|---|---|
| | | HIGH | MID | LOW | | |
| No. 5 | 100 to 200° | 2° | 5½° | 9° | 100° | 220° |
| No. 6 | 135 to 235° | 3° | 6½° | 10° | 100° | 260° |

**ELECTRICAL CAPACITY**: Either A.C. or D.C., 10 amp.-115V., 5 amp.-230V. (can be furnished on special order for 3 amp.-440V.—add to list $3.00).

**MOTOR RATING**: 1 H.P. Repulsion-Induction, ½ H.P. Split Phase or D.C.

**SPECIAL CIRCUITS**: Available double pole and two circuit—When so furnished the minimum differentials are approximately double those listed above. For ordering data and list prices see page 56.

| TYPE NO. | RGE. NO. | RANGE ADJ. | CODE | LIST PRICE |
|---|---|---|---|---|
| DA-36 | 5 | 100-200° | utock | $10.50 |
| DA-36 | 6 | 135-235° | utodl | 10.50 |
| DA-37 | 5 | 100-200° | utoxm | 10.50 |
| DA-37 | 6 | 135-235° | utofn | 10.50 |
| DA-36-3 | 5 | 100-200° | utogo | 10.50 |
| DA-36-3 | 6 | 135-235° | utohg | 10.50 |
| DA-37-3 | 5 | 100-200° | utoxq | 10.50 |
| DA-37-3 | 6 | 135-235° | utoyr | 10.50 |
| DA-36-153 | 6 | 135-235° | utoks | 11.00 |
| DA-37-153 | 6 | 135-235° | utolt | 11.00 |

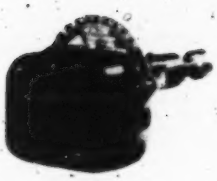
For Centigrade graduations—
Code "utish" No extra charge

TYPE DA-36 and DA-37 controls open circuit as temperature rises.

TYPE DA-36-3 and DA-37-3 controls close the circuit as temperature rises.

TYPE DA-36-153 and DA-37-153 controls are equipped with two circuit switch (Fig. 9-64, three wire—capacity 4 amp.-115V., 2 amp.-230 V.). One circuit closes as other circuit opens. Suitable for either high or low voltage applications.

Shipping weight: approx. 5 lbs.



TYPE 115-A FRONT VIEW

## TYPE 115-W MERCOID IMMERSATHERM

**The Mercoid Immersatherm is a compact and efficient, yet low priced, summer-winter hot water control for use with steam, vapor and hot water systems employing indirect domestic hot water heaters. It also has many other applications in industrial fields for controlling temperatures of liquids or gases not injurious to copper.**

It is simple in operation and the low voltage two-wire system simplifies installation. To insure a continuous supply of domestic hot water from the indirect heater, the Immersatherm is connected in parallel with the low voltage thermostat circuit. During periods when the thermostat is not calling for heat, the Immersatherm operates the heating equipment to continuously maintain the boiler water temperature below the steaming point. This continuous supply of hot water circulating thru the indirect water heater insures a steady supply of domestic hot water the year round.

Two low voltage cable clamping posts are provided within the Immersatherm case to simplify the wiring at the time of installation. The multiple hook-up with the thermostat can be made within the control rather than by splicing connections outside.

The Immersatherm has a calibrated outside adjustment from 50 to 250° or 170 to 430° F. and operates on a fixed differential of approximately 12°F. To set the range it is merely necessary to move the external adjustment pointer to the required temperature.

The Mercoid Type 9-81 sealed mercury contact switch employed remains in a stationary position. A small permanent magnet, actuated by a bimetal coil, moves towards or away from the switch as the temperature rises or falls and accordingly opens or closes the circuit. As very little energy is required to move the magnet, a very small bimetal coil can be employed which is sealed in a close fitting copper shell.

Due to the rapid heat transfer thru the copper shell, and to the small mass of the bimetal employed, the Immersatherm quickly responds to changes in boiler water temperature and provides positive and accurate control. By eliminating the usual lag found in controls employing heavier bimetal, the boiler water can be held at a higher temperature without overshooting or producing steam.

The small size and construction of the Immersatherm facilitates ease of installation. This instrument swings in a 4-inch circle and the mounting stem 6⅛ inches long permits passing thru boiler insulation. The threaded connection is ½ inch I.P.S. and only 1⅛ inch boiler clearance is required.

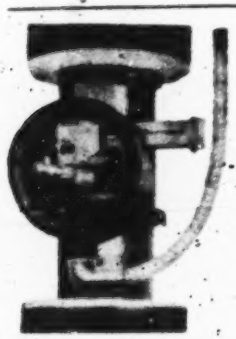
### SPECIFICATIONS

**TYPE 115W**: Low voltage—9/10th amp.-24 Volts. Circuit opens as temperature rises.
**TYPE 115W-3**: Low voltage—9/10th amp.-24 Volts. Circuit closes as temperature rises.
**TYPE 115WA**: Line voltage—20 watts, 115 or 230 Volt. Circuit opens as temperature rises.
**TYPE 115WA-3**: Line voltage—20 watts, 115 or 230 Volt. Circuit closes as temperature rises.

| TYPE NO. | RANGE ADJ. | CODE | LIST PRICE |
|---|---|---|---|
| 115-W | 50-250° F. | utqra | $ 8.50 |
| 115-W-3 | 50-250° F. | utqsb | 8.50 |
| 115-WA | 50-250° F. | utqtc | 8.50 |
| 115-WA-3 | 50-250° F. | utqud | 8.50 |
| 115-W | 170-430° F. | uvpyr | 12.00 |
| 115-W-3 | 170-430° F. | uvpzs | 12.00 |
| 115-WA | 170-430° F. | uvqah | 12.00 |
| 115-WA-3 | 170-430° F. | uvqbi | 12.00 |

For Centigrade graduations—
Code "utinn" No extra charge

NOTE: Type 115-WA and 115-WA-3 have electrical capacity of only 20 watts at 115 or 230 volts. Do not use for direct control of motors larger than 1/60 H.P. For larger motors use Types DA-36 or DA-37 or Type 115-W in connection with Type V Transformer Relay.



## MERCOID RISERTHERM • CLAMP-ON TYPE

The Mercoid Risertherm is a temperature limiting control designed to be clamped on risers of hot water heating systems or the surfaces of hot water tanks.

Furnished with a convenient outside adjustment and a graduated scale to facilitate a quick and easy setting for any required temperature. Provided with a simple, interchangeable mounting, so that instrument can be attached to either vertical or horizontal pipes. Pipe straps with clamps are furnished, which hold the instrument securely in place on any size pipe.

**FIG. 35** is a limit control for hot water systems. Standard range 110 to 200° F. Approx. differential 6° to 25° F., depending upon size of pipe and operating condition of installation. Furnished standard 10 amp. single pole. Circuit opens on rising temperature.

**FIG. 35L**. Two circuit—low voltage. Recommended as limit control in connection with three wire low voltage damper motors or other "series 20" equipment. Capacity 4 amps. 25 volts.

**FIG. 34** is for use in connection with a thermostat for dual control of unit heaters, to prevent operation of the fan until the coils are heated. This prevents circulation of cold air and insures economical operation. Standard range 140 to 230° F. Approx. differential 8° to 25° F., depending upon installation conditions. Furnished standard 10 amp. single pole. Circuit closes on rising temperature.

**ELECTRICAL CAPACITY**: Either A.C. or D.C., 10 amp.-115V., 5 amp.-230V. Available on special order 3 amp.-440V.—add to list $3.00.

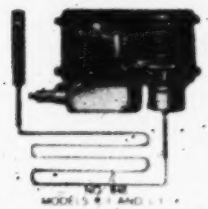
**MOTOR RATING**: 1 H.P. Repulsion-Induction, ½ H.P. Split Phase or D.C.

| FIG. NO. | RANGE ADJ. | CODE | LIST PRICE |
|---|---|---|---|
| 35 | 110-200° F. | utqve | $6.00 |
| 35 | 140-230° F. | utqyh | 6.50 |
| 35L | 110-200° F. | utqzi | 7.00 |
| 34 | 140-230° F. | utraw | 6.50 |

Shipping weight: approx. 5¾ lbs.

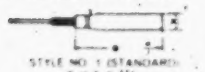
# TEMPERATURE CONTROLS

EQUIPPED WITH THE MERCOID SEALED MERCURY CONTACT SWITCH

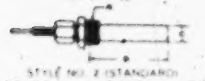


NO. 848
MODELS K-1 AND L-1

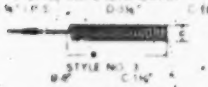
AVAILABLE STYLE BULBS



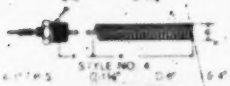
STYLE NO. 1 (STANDARD)
8 P.S. C.H.



STYLE NO. 2 (STANDARD)
4 N.P.S. D.3/4" C.1/8"



STYLE NO. 3
8 P.S. C.1/4"



STYLE NO. 4
4 P.S. C.1/4" D.9" C.6"

STYLE NO. 5
COILED BULB LENGTH—10 FT.

## NO. 848 MODELS K-1, L-1, M-1, N-1

**No. 848** Mercoid remote stem controls are recommended wherever close regulation of liquid, air or gases is desired at temperatures for which Type DA-35 (see page 21) is not available. These instruments employ a seamless all metal bellows, which is actuated by the expansion of a volatile liquid within the remote bulb. They are suitable for use only with liquids or gases not injurious to copper or brass.

**MODELS K-1 AND L-1**—For use on liquids, air or gas. Furnished standard with bulb styles Nos. 1 or 2.

**MODELS M-1 AND N-1**—For very close regulation of air or gas. Furnished standard with bulb styles Nos. 3, 4 or 5.

### RANGES AND DIFFERENTIALS

| MODEL | ADJUSTABLE OPERATING RANGE | APPROXIMATE DIFFERENTIALS — WHEN RISING OPERATING POINT SET AT LOW | MED | HIGH | WHEN FALLING OPERATING POINT SET AT LOW | MED | HIGH |
|---|---|---|---|---|---|---|---|
| K-1, M-1 | — 5° to + 80° | 8° | 4° | 2½° | 37° | 32° | 19° |
| | 15° to 110° | 9° | 4½° | 2½° | 41° | 36° | 21° |
| | 30° to 135° | 9° | 5° | 2½° | 45° | 38° | 23° |
| | 70° to 180° | 10° | 5° | 2½° | 48° | 40° | 24° |
| L-1, N-1 | — 5° to + 35° | 4° | 3° | 2° | 18° | 12° | 8° |
| | *10° to 70° | 3½° | 2½° | 1½° | 18° | 12° | 8° |
| | 55° to 95° | 3° | 2° | 1½° | 18° | 12° | 9° |
| | 60° to 120° | 3° | 2½° | 1½° | 18° | 13° | 9° |
| | 80° to 150° | 4° | 2½° | 2° | 19° | 14° | 10° |
| | *122° to 195° | 4° | 2½° | 2° | 20° | 15° | 10° |
| | 180° to 235° | 4° | 3° | 2° | 20° | 15° | 11° |
| | 195° to 260° | 3½° | 2½° | 1½° | 18° | 13° | 9° |
| | 235° to 305° | 3½° | 2½° | 2° | 20° | 14° | 10° |
| | 270° to 345° | 3½° | 2½° | 2° | 18° | 14° | 11° |

*Standard ranges regularly carried in stock.

Standard flexible tube, 4 ft. long. Can be furnished on special order up to 40 ft. To facilitate delivery, elements with tubing 4, 8, 14, and 20 ft. long are carried in stock. Other lengths require 6 to 8 weeks for delivery.

For tubing of extra length over 4 ft., 25c/net for each extra foot. Minimum charge, $2.50. No extra charge for tubing 8 ft. long. Galvanized armor on tube—5c net per foot, minimum charge 50c.

**ELECTRICAL CAPACITY:** Either A.C. or D.C., 10 amp. 115V.; 5 amp. 230V. (Available on special order 3 amp. 440V., A.C. or D.C. - add to list $3.00)

**MOTOR RATING:** 1 H.P. Repulsion-Induction; ½ H.P. Split-Phase or D.C.

**SPECIAL CIRCUITS:**

10 amp., Single Pole-Double Throw, or Double Pole-Single Throw ..... add to list $3.00
4 amp., Single Pole-Double Throw, or Double Pole-Single Throw ..... add to list $1.50

| MODEL NO. | RANGE | LIST PRICE |
|---|---|---|
| K-1 | All listed ranges | $34.00 |
| L-1 | All listed ranges | 34.00 |
| M-1 | All listed ranges | 38.00 |
| N-1 | All listed ranges | 38.00 |

Where installation conditions are such that at times the temperature surrounding the bulb will be colder and at times warmer than that surrounding the control, notation to that effect must appear on order. To meet these conditions, a special bulb, which is longer than standard, will be furnished.

Shipping weight approx. 8 lbs.

NO. 848
MODELS G-1 AND H-1
STRAIGHT STEM TYPE

NO. 848
MODELS G-2 AND H-2
BATH ANGLE TYPE

## No. 848 MERCOID CONTROLS — Models G-1, H-1, G-2, H-2

**NO. 848** Mercoid mercury contact controls are recommended wherever close regulation is desired at temperatures for which Types DA-36 or DA-37 (see page 20) are not available. These instruments employ a seamless all-metal bellows, which is actuated by the expansion of a volatile liquid within the brass bulb. They are suitable for controlling temperatures of water, steam, oil, or any liquid not injurious to brass.

Models G-1 and H-1 have the temperature bulb projecting from the bottom. On Models G-2 and H-2 the bulb projects from the back. Model G instruments have a wider adjustable range than Model H, but do not furnish so close control. The brass bulbs are 3 in. long, and have ½ in. I.P.S. connections.

### ADJUSTABLE RANGES AND DIFFERENTIALS

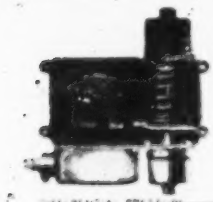
| MODEL | ADJUSTABLE OPERATING RANGE | APPROXIMATE DIFFERENTIALS — WHEN RISING OPERATING POINT SET AT LOW | MED | HIGH | WHEN FALLING OPERATING POINT SET AT LOW | MED | HIGH |
|---|---|---|---|---|---|---|---|
| G-1, G-2 | 15° to 110° | 9° | 4½° | 2½° | 41° | 36° | 21° |
| G-1, G-2 | 30° to 135° | 9° | 5° | 2½° | 45° | 38° | 23° |
| G-1, G-2 | 70° to 180° | 10° | 5° | 2½° | 48° | 40° | 24° |
| H-1, H-2 | 10° to 70° | 3½° | 2½° | 1½° | 18° | 12° | 8° |
| H-1, H-2 | 35° to 95° | 3° | 2° | 1½° | 18° | 12° | 9° |
| H-1, H-2 | 60° to 120° | 3° | 2½° | 1½° | 18° | 13° | 9° |
| H-1, H-2 | 80° to 150° | 4° | 2½° | 2° | 19° | 14° | 10° |
| H-1, H-2 | 195° to 260° | 3½° | 2½° | 1½° | 18° | 13° | 9° |

**ELECTRICAL CAPACITY, MOTOR RATING, AND SPECIAL CIRCUITS** Same as Models K-1 and L-1 (see above).

| MODEL | RANGE | LIST PRICE |
|---|---|---|
| G-1, H-1 | All listed ranges | $25.00 |
| G-2, H-2 | All listed ranges | 25.00 |

Shipping weight approx. 6 lbs.

# DIFFERENTIAL CONTROL



DIFFERENTIAL PRESSURE
TYPE

## NO. 848 MERCOID DIFFERENTIAL CONTROL

For Control by Difference in Pressure, Vacuum or Temperature

**No. 848** Mercoid Differential Controls make and break circuit according to change in the difference between two pressures or two temperatures. The two bellows power elements are opposed to each other and operate the switch as the difference widens or narrows.

For example: To start a pump as the difference between two liquid levels changes, a Differential Pressure Control would be used operating by head pressure. Similarly, circuit may be made or broken according to variation in the difference between two steam pressures or two air pressures.

No. 848 Mercoid Differential Controls can also be supplied for temperature differences, using thermal elements of Models G, H, K, L, M, N and S. For example: On heated water to start a circulating pump according to the difference in temperature between the supply and return, or to start a Unit Heater in a pump house according to the difference in temperature inside and out.

Differential Controls are built on order to meet the requirements of each installation and cannot be carried in stock. Prices depend on application. When requesting quotation, furnish complete data covering the installation.

# MERCOID COAL STOKER CONTROLS

EQUIPPED WITH THE MERCOID SEALED MERCURY CONTACT SWITCH

TV2 STOK-A-TIMER

## TYPE TV2 MERCOID STOK-A-TIMER

A compact unit combining the Mercoid Transformer relay and a synchronous motor timer mechanism for maintaining the stoker fire during periods when the thermostat does not call for heat. This instrument incorporates the following important features:
**CANNOT OPERATE IMMEDIATELY AFTER THERMOSTAT SHUTS OFF**: A mechanical interlocking mechanism prevents it from operating the stoker immediately after the thermostat shuts off. This prevents overheating and waste of fuel.
**INTERVAL ADJUSTMENT**: Can be set for ½ hr. or 1 hr. interval merely by moving a lever to the position desired. No change of cams is required.
**FIRE MAINTAINING PERIOD**: Adjustable on graduated dial from 30 sec. to 12 min. A pointer can be moved by hand to the position desired.
**LOW VOLTAGE RELAY**: The Mercoid Transformer Relay built into this control induces its own low voltage on the thermostat circuit and is absolutely quiet in operation.
**MERCOID MERCURY CONTACT SWITCHES**: Eliminate unnecessary service as the contacts cannot be affected by dust, dirt or corrosive gases.
**ELECTRICAL CAPACITY**: Standard for 10 amp. 115V., 60 cycle. Available at no extra charge for 5 amp. 230V., 60 cycle.
**MOTOR RATING**: ¼ H.P. Repulsion-Induction; ⅛ H.P. Split Phase.

| TYPE NO | VOLTAGE | CODE | LIST PRICE |
|---|---|---|---|
| TV2-3A | 115V., 60cyc. | uvguw | $18.00 |
| TV2-3B | 115V., 50cyc. | uvgwy | 19.00 |
| TV2-3D | 115V., 25cyc. | uvgva | 19.00 |
| TV2-3F | 230V., 60cyc. | uvhap | 19.00 |
| TV2-3G | 230V., 50cyc. | uvhcr | 19.00 |
| TV2-3J | 230V., 25cyc. | uvhds | 19.00 |

Shipping weight 5 lbs.

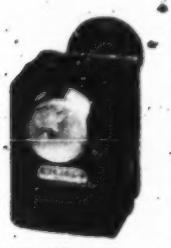
TYPE M-63SW

## TYPE M-63SW OUTFIRE STOKER CONTROL

Type M-63SW is a stack mounted, temperature operated control designed to automatically stop the stoker in event the fire should go out or the fuel become exhausted. This prevents operating an empty stoker and guards against filling the combustion chamber with unburned fuel—a condition most unpleasant to the operator.
The Mercoid switch is of the enclosed mercury contact type. It is not subject to operating corrosion, oxidation or pitting and will operate indefinitely without deterioration. The mechanism of this control has many outstanding features. The dial located in the center of the instrument, slowly rotates as the temperature on the bi-metal coil increases or decreases. This dial is clearly calibrated from 50 to 650°F. and a pointer indicates the temperature in the stack—enabling the installation or service man to check the operation.
A simple double adjustment is provided for setting both the "high" and "low" operating points. The range can be adjusted over the entire scale, and the differential can be set for very close operation. The usual setting is approximately 100°F.
Standard instruments are furnished with a stainless steel well enclosing the bi-metal operating coil. This protects the coil, not only from deposits of fly ash, but also against corrosive stack gases.
Furnished standard with a lock type manual switch button to permit starting the stoker after the fire has gone out. Turning the button locks the switch in the "on" position. When the fire is again started the stack temperature rises and the manual switch automatically unlatches and restores the control to normal operation.
**ELECTRICAL CAPACITY**: 10 amp. 115V., 5 amp. 230V. either A.C. or D.C.
**MOTOR RATING**: ¼ H.P. Repulsion-Induction; ⅛ H.P. Split Phase or D.C.

| TYPE NO | RANGE ADJ. | CODE | LIST PRICE |
|---|---|---|---|
| M-63SW | 50-650° F. | uvosy | $18.50 |

Shipping weight approx. 4½ lbs.



JMV STOKATHERM

## TYPE JMV MERCOID STOKATHERM

The STOKATHERM, is based on a new principle of operation. It combines the advantages of Timer and stack controls, and at the same time overcomes the former weaknesses and disadvantages of these devices. Note the following important features:
**FIRE MAINTAINING**: The Stokatherm operates the stoker for only the very shortest periods necessary to maintain a minimum fire while the thermostat is in the off position.
**LIMITS OVERHEATING**: The firing periods, being directly responsive to combustion conditions, are not at definitely timed intervals or governed by fixed stack temperatures, but are automatically regulated to meet the variable conditions encountered.
**FUEL SAVING**: As domestic stokers operate approximately 80% of the heating season on the fire maintaining controls, the economical, short operations of the Stokatherm, not only result in a very decided fuel saving, but also insure against overheating.
**OUT-FIRE OPERATION**: Should the fuel become exhausted, or the fire go out, the Type JMV Stokatherm automatically stops the stoker. This prevents operating an empty stoker and guards against filling the combustion chamber with unburned fuel.
**LOW VOLTAGE RELAY**: The Mercoid Transformer Relay built into this control induces its own low voltage on the thermostat circuit and is absolutely quiet in operation.
**MERCOID MERCURY CONTACT SWITCHES**: Eliminate unnecessary service as the contacts cannot be affected by dust, dirt or corrosive gases.
**ELECTRICAL CAPACITY AND MOTOR RATING**: Same as TV2 above.

| TYPE NO. | VOLTAGE | CODE | LIST PRICE |
|---|---|---|---|
| JMV 3A | 115V. 60cyc. | uvhel | $28.00 |
| JMV 3B | 115V. 50cyc. | uvhfu | 30.00 |
| JMV 3D | 115V. 25cyc. | uvhiz | 30.50 |
| JMV 3F | 230V. 60cyc. | uvhjy | 29.00 |
| JMV 3G | 230V. 50cyc. | uvhla | 30.00 |
| JMV 3J | 230V. 25cyc. | uvhod | 30.50 |

Shipping weight 9 lbs.

# STOKER CONTROLS FOR APARTMENTS, HOTELS OR FACTORIES

T2 STOK-A-TIMER

## TYPE T2 MERCOID STOK-A-TIMER

The STOK-A-TIMER is recommended for industrial applications such as in apartment buildings, hotels, etc., where no thermostat is employed but where it is desired to maintain the fire during mild days or night periods when heating is not required.
During periods when heat is required the stoker operation is governed entirely by the boiler limit control. When heating is not required the STOK-A-TIMER can be connected into the circuit either automatically by means of an electric time switch, or by manually throwing a switch. The stokes will then operate periodically for short intervals as required to prevent the fire going out.
The Type T2 STOK-A-TIMER consists of a synchronous motor timer mechanism which actuates a Mercoid switch. It incorporates the following important features:
**SYNCHRONOUS MOTOR**: Self starting type of the highest quality, enclosed in dust tight case with sealed in lubrication.
**INTERVAL ADJUSTMENT**: The interval between firing periods can be adjusted from ½ hr. to 1 hr. by moving lever to position desired. No change of cams is required.
**FIRE MAINTAINING PERIOD**: The length of time the stoker fires at each operation is adjustable from 30 sec. to 12 min. A pointer can be moved by hand to the time desired as shown on the calibrated dial.
**MERCOID SWITCH**: The Mercoid sealed mercury contact switch eliminates unnecessary service as the contacts cannot be affected by dust, dirt or corrosive gases.
**AMPLE WIRING SPACE** is provided for making connections to terminal posts.
**ELECTRICAL CAPACITY AND MOTOR RATING**: Same as Type TV2 above.

| TYPE NO | VOLTAGE | CODE | LIST PRICE |
|---|---|---|---|
| T2-A | 115V. 60cyc. | uvhpe | $17.00 |
| T2-B | 115V. 50cyc. | uvhsh | 18.00 |
| T2-D | 115V. 25cyc. | uvhti | 18.50 |
| T2-F | 230V. 60cyc. | uvhlj | 17.00 |
| T2-G | 230V. 50cyc. | uvhyn | 18.00 |
| T2-J | 230V. 25cyc. | uvhzo | 18.50 |

Shipping weight approx. 4 lbs.

586

# DETROIT LUBRICATOR COMPANY

BULLETIN No. 62 | *Subject* Stoker Controls | September 30, 1933

Defendant's Exhibit R

# "GENUINE DETROIT" CONTROLS

FOR

# STOKERS

THERMOSTATS

LIMIT CONTROLS

HOLD-FIRE CONTROLS

LOW WATER CONTROLS

RELAY-TRANSFORMERS

MOTOR UNITS


## DETROIT LUBRICATOR COMPANY

ESTABLISHED 1877

MAIN OFFICE AND WORKS

TRUMBULL, LINCOLN, MARQUETTE AND VIADUCT, DETROIT, MICHIGAN, U. S. A.

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DIVISION OF AMERICAN RADIATOR & STANDARD SANITARY CORPORATION

CANADIAN REPRESENTATIVE — RAILWAY & ENGINEERING SPECIALTIES LIMITED, MONTREAL, TORONTO, WINNIPEG

PRINTED IN U. S. A.

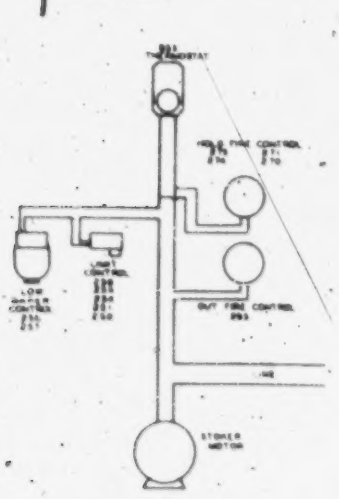
# "GENUINE DETROIT" STOKER CONTROLS

The controls listed herein provide a complete line of Stoker Controls for both high voltage and low voltage, thus enabling the engineer to select the types best suited to his needs and obtain the complete system from one manufacturer. The advantage of the "undivided responsibility," which results where each control has been especially developed to operate in connection with the others, is obvious. An important feature of "GENUINE DETROIT" Controls is the use of the "two-wire" system which simplifies the instruments and provides cheaper and quicker installation, with minimum liability of error on the part of the installer.

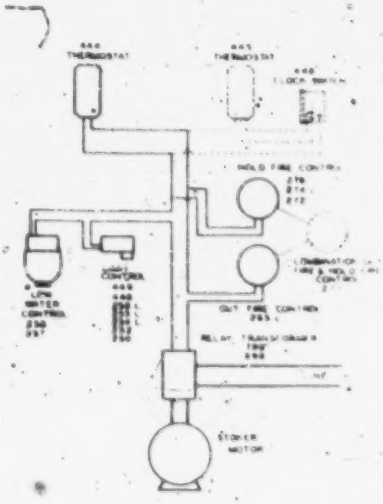
On Domestic installations, the "Operating Control" as used for Commercial jobs becomes a "Limit Control" and is wired in series with the room Thermostat to prevent excessive pressure or temperature in the Boiler or Furnace. Room Thermostats, Operating or Limit Controls, Low Water Controls, etc., are standard "GENUINE DETROIT" products. Information as to interior construction and method of operation is provided by individual circulars, which will be sent on request.

## Patent Notice

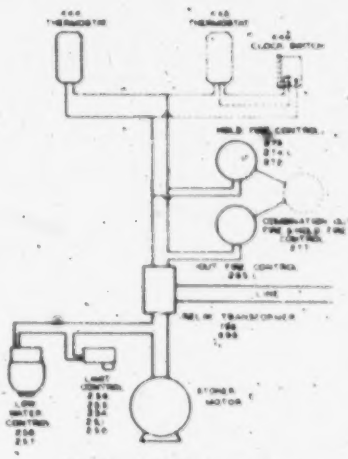
Hold Fire Controls carry with them a license to use a system of preventing extinguishment of the fire when operating under low heat requirement conditions as covered by patents numbers 1,758,146 and 1,758,147 and or 1,882,341 as the case may be.



High Voltage System



Low Voltage System



Combination High and Low Voltage System

Stoker Control Systems can be classified generally in three types High Voltage, Low Voltage, and combination of High and Low Voltage. The wiring diagram for these and a brief description of each are given herewith. While some engineers may prefer other types, the "Combination System" is, we believe, most generally preferred as it saves the high cost of running BX or conduit through the walls to the Thermostat and yet provides the Limit or Safety Control in the high voltage circuit independent of the Relay.

**High Voltage System.** No Transformer is needed and no Relay on motors up to 1 H. P. High Voltage wiring throughout.

**Low Voltage System.** A Relay Transformer is used with all controls on a 20 volt circuit. The Limit or Safety Control operates through the Relay.

**Combination High and Low Voltage System.** A 20 volt circuit is used for the Thermostat and Hold Fire Control providing easier and cheaper wiring through the walls. (The Out Fire Control may be in either the Low or High Voltage Circuit.) The Limit or Safety Controls are in the maincircuit to the motor independent of the Relay.

For Commercial jobs where no room Thermostat is used, we recommend the High Voltage System.

# HOLD-FIRE CONTROLS

When Domestic Stokers are installed with room Thermostats there is liability of the fire "going out" on mild days where for long periods the Thermostat is satisfied. To prevent this, Hold-Fire Controls are wired in parallel with the room Thermostat to operate the Stoker at intervals, maintaining the fire but not continuing combustion to a point where the building would be over heated. See diagrams page 2. For all Furnace and Hot Water jobs and frequently for Steam jobs, a temperature control in the stack is used. On Steam installations it may be desired to employ a Hold-Fire Control actuated by the temperature of the boiler water. These Controls are set to break circuit and stop the Stoker before the water reaches the steaming point, thus preventing heat in the radiators. Back connection Immersion Controls are inserted into the Boiler below the water line. Where External Water Heaters are installed a straight connection Immersion Control is inserted in a tee in the piping between the Boiler and Heater or a Clamp-On Control strapped to the piping.

All Hold-Fire Controls Nos. 275, 274, 270, 271, 278, 274 L, 272, 277, carry a license to use these controls under the aforementioned patented system and all such Controls bear a name plate reading as follows:

**Patent Notice**

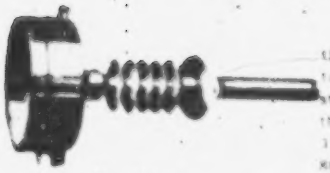
This Control carries with it a license to use a system of preventing extinguishment of the fire when operating under low heat requirement conditions as covered by patent numbers 1,758,146 and, 1,758,147 and or 1,882,341 as the case may be.

## HOLD-FIRE CONTROLS—HIGH VOLTAGE

All high voltage Hold Fire Controls carry the same rating as high voltage operating or Limit Controls page 4

### No. 275 Hold-Fire Control

**For Stack Temperature**



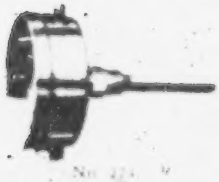
No. 275

The No. 275 Hold Fire Control is for insertion in the stack. The bi metal thermal coil is completely covered by a corrosion resisting monel well attached to the removable flange. Flange can be bent to conform to the radius of the stack. Stem is equipped with radiating fins to insure a cool temperature in the control case. Adjustable range 100° to 500°. Differential approximately 15° minimum adjustable to 115° maximum. Thermal element will withstand 800° to 900° without damage. Extension of stem 3½ inches into stack. Shipping weight, 5 lbs.

| | LIST PRICE Single Throw |
|---|---|
| | $19.00 |

### No. 274 Hold-Fire Control

**Immersion Type for Water Temperature**



No. 274

The No. 274 Hold Fire Control is a back connection Immersion Control employing a bi metal thermal coil enclosed in a removable well. Temperature range 100° to 300°. Differential approximately 15° minimum adjustable to 55° maximum. Well has ¾" pipe thread. Extension of bulb within opening 3¾ inches. Shipping weight 3 lbs.

| | LIST PRICE Single Throw |
|---|---|
| | $14.50 |

### No. 270 Models MH-1, MH-2 Hold-Fire Controls

**Immersion Type for Water Temperature**

No. 270

The No. 270 Type Hold Fire Controls employ a liquid charged bellows for the thermal element. Model MH 1 straight connection. Model MH 2 back angle connection. Bulb size ½" x 3½" thread ¾" I P S. Removable well can be supplied on special order. Temperature range 120° to 210°. Average minimum differential 9°, maximum 21°. Shipping weight 4 lbs.

| | LIST PRICE Single Throw | Double Throw |
|---|---|---|
| MH 1 | $17.00 | $20.00 |
| MH 2 | 17.50 | 20.50 |
| Removable Well Extra | 1.00 | 1.00 |

# HOLD-FIRE CONTROLS—HIGH VOLTAGE

(CONTINUED)

No. 271

## No. 271 Hold-Fire Control

**Clamp-On Type for Water Temperature**

The No. 271 Hold Fire Control operates by surface contact strapped to hot water pipes. Can be installed in any position on vertical or horizontal pipes without change. Two ranges 100° to 200° and 150° to 250°. Minimum differential approximately 10° adjustable to 50° maximum. Shipping weight 3 lbs.

LIST PRICE
Single Throw
$11.50

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# HOLD-FIRE CONTROLS—LOW VOLTAGE

The Low Voltage Hold Fire Controls operate in the same manner as the High Voltage Controls. These Controls also carry the license to use the patented system and bear the license plate.

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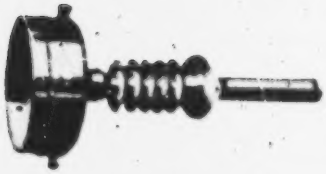

No. 278

## No. 278 Hold-Fire Control

**For Stack Temperature**

The No. 278 Hold Fire Control is similar to the No. 275 but is equipped with binding posts for low voltage wiring. Thermal element protected by a corrosion resisting monel well attached to the removable flange. Flange can be bent to conform to the radius of the stack. Stem equipped with radiating fins to insure a cool temperature in the control case. Adjustable range 100° to 500°. Differential approximately 15° minimum, adjustable to 100° maximum. Thermal element will withstand 800° to 900° without damage. Extension of stem 3½ inches into stack. Shipping weight 5 lbs.

LIST PRICE
Single Throw
$19.00

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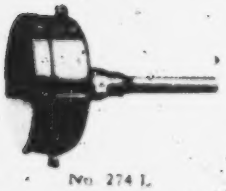

No. 274 L

## No. 274 L Hold-Fire Control

**Immersion Type for Water Temperature**

The No. 274 L Hold Fire Control is similar to the No. 274 high voltage control (page 7) but is equipped with binding posts for low voltage wiring. Regularly supplied with removable well ¾" pipe thread. Range 100° to 300°. Differential approximately 15° minimum adjustable to 65° maximum. Extension of bulb within opening 3¾ inches. Shipping weight 3 lbs.

LIST PRICE
Single Throw
$14.50

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No. 272

## No. 272 Hold-Fire Control

**Clamp-On Type for Water Temperature**

The No. 272 Hold Fire Control is similar to the No. 271 high voltage control (above) but is equipped with binding posts for low voltage wiring. Operates by surface contact and can be installed in any position on vertical or horizontal pipes without change. Two ranges 100° to 200° and 150° to 250°. Minimum differential approximately 10° adjustable to 50° maximum. Shipping weight 3 lbs.

LIST PRICE
Single Throw
$11.50

# OUT-FIRE CONTROLS

Out-Fire Controls are used on both Domestic and Commercial installations to prevent the feeding of green coal to the fire pot, in case the fire should be extinguished. Out-Fire Controls **break** circuit on temperature decrease and are wired in series with the Operating or Limit Control (and Thermostat if used) to stop the operation of the Stoker as the Stack temperature falls. They are generally set to break the circuit from 25° to 50° below the "make" point of the Hold-Fire Control but above the normal temperature of the basement. To rekindle the fire the indicator is moved to the lowest setting on the scale and moved back to the operating temperature after the stack is heated.

## OUT-FIRE CONTROLS FOR STACK TEMPERATURE

### No. 265 Out-Fire Control—High Voltage Type

LIST PRICE $15.00

Similar to the No. 235 Hold Fire Control (page 7) but with Switch arranged to "break" on decrease. Temperature range 0 to 400°.

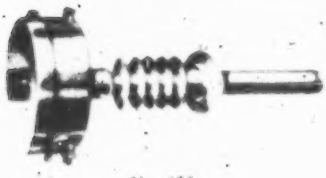
### No. 265L Out-Fire Control—Low Voltage Type

LIST PRICE $15.00

Similar to the No. 278 Hold Fire Control (page 8) but with switch arranged to "break" on decrease. Temperature range 0 to 400°.

### No. 277 Combination Hold-Fire and Out-Fire Control

**Low Voltage for Stack Temperature**



No. 277

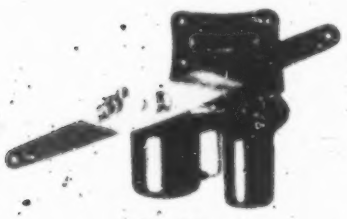
The No. 277 combines in one control the Hold Fire and Out Fire features. The Out Fire Switch is attached to the adjustment arm of the Hold Fire Switch and is regularly set to break circuit 50 degrees below the make point of the Hold Fire Switch. Can be adjusted to break circuit with wider or closer difference. A switch is provided at the binding posts of the Out Fire circuit for use at rekindling time. The switch is thrown to close this circuit until the stack is heated. Range 100° to 500°. Differential on Hold-Fire Switch adjustable from 15° to 200°. The No. 277 carries the license to use the patented system.

LIST PRICE $21.50

Thermal element is protected by corrosion resisting monel well attached to the removable flange. Flange can be bent to conform to the radius of the stack. Thermal element will withstand from 800° to 900° without damage. Extension of stem 3½ inches into stack. Shipping weight 6 lbs. (Delivery approximately Nov. 1 1933.)

### No. 430 L "GENUINE DETROIT" Motor Unit

**For Damper Control**



No. 430

The No. 430 L Motor Unit operates on the "Thermal Motor" principle. A low voltage, low temperature, electric heating element is inserted in a chamber containing a volatile liquid. When the thermostat makes circuit to the element, the heat vaporizes some of the liquid, increasing the internal pressure, forcing the liquid through a connecting tube which runs from the bottom of the heating chamber to the bellows chamber. Opposing the bellows is a spring which normally keeps the dampers closed. The pressure of the liquid against the head of the bellows overcomes the spring, forces upward on the stem and opens the dampers. When the thermostat breaks circuit the motor unit operates in the reverse manner, closing the dampers.

The motor unit is not strained nor made inoperative in case the electric heating element is "on" for prolonged periods because the heating chamber and the bellows chamber are separate and connected by a capillary tube. For the same reason, the operation of the motor unit is not appreciably changed by variation in temperature of the air surrounding the unit.

Has many applications to operate dampers or valves. Can be used with any "GENUINE DETROIT" Control for Temperature, Pressure or Humidity. For A. C. only up to 25 watts.

No. 839 or No. 836 Transformers should be used with No. 430 motor unit. Regularly furnished with 35 ft. of two wire cable, 35 ft. of damper chain, 4 S. Hooks, 4 ceiling pulleys. Shipping weight approximately 10 lbs.

#### DISTINCTIVE FEATURES

Quiet, no noise during operation.
Ample power to operate dampers.
Simple in design. No wearing out of parts and no attention needed after installation.
Quickly installed. Two wire circuit, low voltage. Licensed electrician not needed.
Operates on lighting current. No batteries needed. Conforms to Underwriters' requirements.
In case of current failure or damage to unit, dampers will automatically be closed.
Automatic release if damper is closed or opened by hand.

#### LIST PRICE

| | | |
|---|---|---|
| No. 430 L | Motor Unit with chain, pulleys, cable, etc. | $15.75 |
| No. 839 | Transformer for 110 Volts 60 Cycles with junction box cover | 3.00 |
| No. 836 | Transformer for 110 Volts 60 Cycles with one foot cord and plug | 3.00 |

Defendant's Exhibit S

# DETROIT LUBRICATOR COMPANY

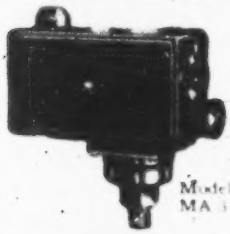
SHEET No. 101-L (*Replaces Sheet 101-K dated May 7, 1937*) September 15, 1937

## "GENUINE DETROIT" CONTROL SWITCHES—HIGH VOLTAGE

PATENT NO. 2088556

All Control Switches described in this catalog will carry 110 or 220 volts A. C. or D. C. See below for motor ratings. All No. 250 Series Control Switches are available on special order for 440 or 550 volts A. C. pilot circuit service.

| VOLTS | A. C. MOTORS | | D. C. MOTORS |
|---|---|---|---|
| | Repulsion-Induction | Split Phase | |
| 110 or 220 | 1 H. P. | ¼ H. P. | ½ H. P. |



Model MA-1

### No. 250 Pressure Control Switches

For pressure control on steam, air, gas, water, etc. Both main and differential adjustments quickly and easily made.

| Model | Range | Min. Dif. | Max. Dif. | Ship. Wt. | LIST PRICES Single Throw | Double Throw |
|---|---|---|---|---|---|---|
| MA-1 | 0 lbs. — 10 lbs. | 1½ lb. | 8 lbs. | 3 lbs. | *$ 8.00 | $11.00 |
| MA-2 | 30" Vac. — 2" Vac. | 2" Vac. | 17" Vac. | 3 lbs. | 14.00 | 17.00 |
| MA-3 | 10" Vac. — 15 lbs. | 1¾ lb. | 14 lbs. | 3 lbs. | *12.00 | 15.00 |
| MB-1 | 10 lbs. — 60 lbs. | 10 lbs. | 10 lbs. | 3 lbs. | *12.00 | 15.00 |
| MB-4 | 15 lbs. — 90 lbs. | 3 lbs. | 20 lbs. | 3 lbs. | *12.00 | 15.00 |
| MB-6 | 5 lbs. — 160 lbs. | 5 lbs. | 30 lbs. | 4 lbs. | *14.00 | 17.00 |
| MB-7 | 60 lbs. — 350 lbs. | 7½ lbs. | 75 lbs. | 4 lbs. | 20.00 | 23.00 |

Hand Reset, $2.00 extra to list. Models MB-6 and MB-7 regularly supplied with 10' flexible tubing. When used on cold substances this tubing is not needed. For such deduct $1.00 from list price. Connection ¼" male I. P. S. For 440 or 550 volt A. C. pilot circuit service add $1.00 to List. For additional information, see Bulletin No. 144. *Carried in stock.

Model MC-2

### No. 250 Vapor Control Switch

Similar to Models MA and MB except with larger bellows to provide close control. Model MC-2 range 3" vacuum to 3½ lbs., differential adjustable from 4 ozs. minimum to 1 lb. maximum. Model MC-1 range 2 ozs. to 5 lbs., differential adjustable from 6 ozs. minimum to 1¼ lbs. maximum. Both models ¼" male I. P. S. Shipping weight 5 lbs. Carried in stock.

For additional information, see Bulletin No. 54.

| LIST PRICES | |
|---|---|
| Single Throw | $11.00 |
| Double Throw | 16.00 |
| Hand reset add to list | 2.00 |
| For 440 or 550 volt A. C. pilot circuit service add to List | $1.00 |

Model MJ

### No. 251 Model MJ and Model MU Clamp-on Control Switch

For Temperature control by surface contact. Clamps to hot water or steam pipes. Model MJ "makes" circuit on temperature decrease. Model MU "makes" circuit on temperature increase. Can be installed in any position on vertical or horizontal pipes without change. Range 80° to 180°, 100° to 200° or 150° to 250°. Differential normally 12°. Can be widened by adjustment under the cover. Regularly carried in stock range 160° to 200° or 150° to 250°—both models. Shipping weight 3 lbs.

For additional information, see Bulletin No. 165.

| LIST PRICE Single Throw |
|---|
| $8.00 |
| Hand reset add $2.00 to List |

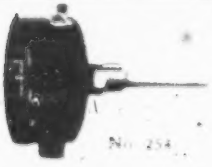
Model MH-1

### No. 250 Immersion Hot Water Control Switches

For temperature control on Hot Water Boilers, Tanks, etc. Model MH-1 straight connection. Model MH-2 back angle connection. Bulb size ½" x 3½", thread ½" male I. P. S. MH-2 regularly supplied with separable well, ¾" I. P. S. Standard range 120° to 210° carried in stock. Average minimum differential 4°. Average maximum differential 21°. Other ranges available from 15° low to 260° high. Also furnished to provide average minimum differential 2°. Shipping weight 4 lbs.

For additional information, see Bulletin No. 54.

| LIST PRICES Standard Range | 120° — 210° |
|---|---|
| | MH-1 MH-2 |
| Sgle Throw | $14.00 $15.00 |
| Dble Throw | 17.00 18.00 |
| For 440 or 550 volt A. C. pilot circuit service add to List | $1.00 |
| For other ranges add to list price | $2.00 |
| Hand reset add to list price | $2.00 |



No. 254

### No. 254 Immersion Control Switch

Employs a bi-metal coil and is used for operating as Limit Control where a close differential is not required. Range 100° to 235°. Minimum differential approximately 8° adjustable to 15° maximum. Regularly supplied with removable well, ¾" pipe thread. Extension of bulb within opening 3⅞ inches. Carried in stock. Shipping weight 3 lbs.

For additional information, see Bulletin No. 92.

| LIST PRICE Single Throw |
|---|
| $11.00 |

# "GENUINE DETROIT" CONTROL SWITCHES—HIGH VOLTAGE

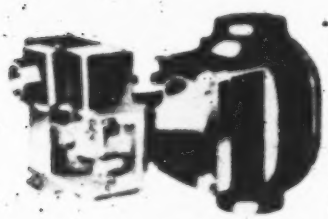
No. 253

## No. 253 and 243 Combination Fan and Limit Switch

The No. 253 and 243 combine in one unit a high voltage Fan Switch to prevent starting the fan until heat is present in the furnace bonnet and blowing cold air into the house together with a limit switch to shut off the stoker, oil or gas burner or damper regulator on coal fired furnaces if excessive heat is present in the bonnet. The No. 253 has a 3½" extension and the No. 243 has a 14½" extension. Shipping weight 4 lbs.

For additional information see Bulletin No. 75.

| | LIST PRICE |
|---|---|
| No. 253 | $16.75 |
| No. 243 | 16.75 |



No. 257

## No. 257 Low Water Fuel Cut Out

The No. 257 Low Water Fuel Cut Out provides safety for the boiler and avoids the hazard of firing a dry boiler. Will carry full line current and is wired direct in the motor circuit, thus insuring positive safety to the boiler. Additional safety features are provided in the design of the instrument, so that in case of damage to the float the circuit will be broken. The Low Water Cut Out is installed a few inches below the normal water line. As the float falls, the circuit is broken thus stopping the stoker, oil or gas burner. On resumption of water level circuit is again automatically made. The control box is of black bakelite having removable cover. Maximum pressure 15 lbs. per square inch. Regularly furnished with connection for BX and with 1" I. P. S. connections for boiler. Normally supplied to break circuit as water level falls. On special order, can be supplied to break circuit as water level rises. Single throw, single pole only. Shipping weight 19 lbs.

For additional information, see Bulletin No. 61.

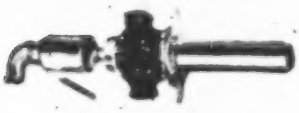
| | LIST PRICE |
|---|---|
| No. 257 | $18.00 |

## No. 259 Combination Fuel Cut Out and Pressure Control

No. 250 Pressure Controls Models MA 1, MA 3, and the Vapor Controls, Models MC 2 or MC 1, can be supplied with the No. 257 Low Water Cut Out. These Controls are mounted on the neck of the No. 257 and the wiring connected in series with the low water switch. This provides an Operating or Limit Control combined with Low Water Cut Out in one unit presenting a neater appearance than the installation of the Pressure Control at the top of the Boiler and saving time, labor and conduit at installation. See page 1 for ranges and differentials of Pressure Controls. In ordering specify the Model Pressure Control desired.

For additional information, see Bulletin No. 61

| LIST PRICES | |
|---|---|
| No. 259 Combination | |
| With Model MA-1 | $28.00 |
| With Model MA-3 | 28.00 |
| With Model MC-2 | 33.00 |
| With Model MC-1 | 33.00 |



No. 545

## No. 545 Boiler Protector

Patent 2,056,760.

The No. 545 "GENUINE DETROIT" Boiler Protector affords positive low water and high pressure protection for steam boilers up to 25 lbs. operating pressure. When the water in the heating system drops below a safe level or if the steam pressure with its correspondding temperatures rise above normal, the flue gases melt a fuse thereby opening an electric switch which shuts off the heat supply. Water connections may be made to openings provided in the boiler or to the gauge glass tappings by means of the No. 546 Quick Hookup Fittings. These fittings consist of 2 Nipples, 2 Tees, 3 Elbow Compression Fittings and 1 Straight Compression Fitting. Copper Tubing is not furnished.

| | LIST PRICE |
|---|---|
| No. 545 "GENUINE DETROIT" Boiler Protector | $12.00 |
| No. 546 Quick Hookup Fittings | 2.15 |
| Extra Fuses—12 lb. per box of five | .70 |

# STOKER CONTROL SWITCHES

## Patent Notice

"Stand by" controls carry with them a license to use a system of preventing extinguishment of the fire when operating under low heat requirement conditions as covered by patent numbers 1,758,146 and 1,758,147 and/or 1,882,341 as the case may be. ("Stand by" Reg. U. S. Pat. Off.)

No. 275 "Stand by" control for Stack temperatures. Adjustable range 100° to 500°. Will withstand 1200°.

No. 271 "Stand by" control, clamp on type. Range 100° to 200° or 150° to 250°.

No. 270 Model MH 1 "Stand by" control for immersion. Straight connection. Range 120° to 210°.

No. 270 Model MH 2 "Stand by" control for immersion. Back angle connection. Range 120° to 210°.

No. 274 "Stand by" control. Immersion type. Range 100° to 235°.

No. 265 Out fire control. For Stack temperature. Range 0° to 400°.

For Stoker Time Relays and Timers write for Bulletin No. 94.

For additional information, see Bulletin No. 62

| | LIST PRICES | |
|---|---|---|
| | Single Throw | Double Throw |
| No. 275 | $16.00 | |
| No. 271 | 13.50 | |
| No. 270 Model MH-1 | 17.00 | $20.00 |
| No. 270 Model MH-2 | 17.00 | 20.00 |
| No. 270 Removable well, extra | 1.00 | |
| No. 274 | 16.50 | |
| No. 265 | 14.00 | |

# Condensed Complete Catalog and Price List

*Effective March 30, 1933* *Subject to change without notice*

Defendant's Exhibit T

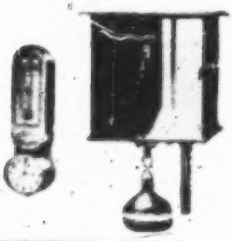
MINNEAPOLIS-HONEYWELL
REGULATOR COMPANY
MINNEAPOLIS, MINNESOTA

# Damper Motors (Continued)—Stoker Control—Relays

## TYPE S MOTOR

Where electric current is not available this spring type motor will provide dependable regulation of dampers. Due to the heavy spring in this unit one winding will operate the average heating plant for two weeks. The motor is actuated by the current from two dry cells or transformer. Should the winding of the motor be neglected the last operation of the motor will always close the drafts.

| TYPE | CODE | SHIP. WT. | LIST PRICE |
|---|---|---|---|
| S | Tommy | 16 lbs. | 25.00 |



## M-H SPECIAL REGULATOR

With this Special Regulator get the many advantages of clock control are available at low cost. The Thermostat is low voltage. It may be operated by two dry cells, or it can be operated by electric current through a bell transformer. In the evening the setting is lowered to a more economical point. Early in the morning it automatically returns the setting to day time requirements. The motor unit is a gravity type. All that is necessary is to pull up the little red weight when firing the furnace or boiler.

(One Day Clock (Series 20)
Scale Range: 50 to 90°F.—Diff.: 2°F.
Motor: Gravity Type.

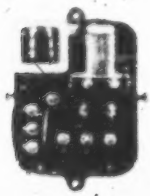
| | | | |
|---|---|---|---|
| Spexk | 21 lbs. | 23.95 Net |

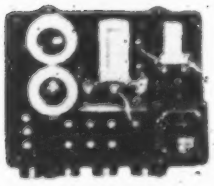
## TYPE L STOKERSWITCH

Type L Stokerswitch is designed to automatically control the operation of domestic and small industrial stokers. Mounted on the stack with the thermal element inserted in the stack it prevents the fire from going out during a prolonged "off" period of the Thermostat because if due to this there is a drop in stack temperatures past a predetermined setting of the stokerswitch it starts up the motor. Some models include the "out fire cut-off" which prevents the addition of green fuel by cutting out the Thermostat and Stokerswitch should the fire for any reason go out. Both models employ Mercury Switches. The "Out fire Cut-off" models uses two Mercury Switches to provide this additional feature.

Type L105-1 (Series 10):
Operating Range: (Adj.) 100 to 600°F.—Diff. (Adj.) 25 to 200°F.
Maximum Allowable Stack Temp.: 900°F.
Suitable for all stacks larger than 9".
Type L205-1 (Series 20): Same as Type L105-1 except arranged for use with Series 20 controls.
Type L405-1 (Series 40): Same as Type L105-1 except arranged for line voltage controls.
Type L105-2, L205-2, L405-2 are the same as L105-1, L205-1 and L405-1 respectively except that they include the "Out fire Cut-off" Switch and Manual reset mechanism.
Current Rating (L405-1 and L405-2): 10A. 110V.; 5A. 220V.
Motor Rating (L405-1 and L405-2): ½ H.P. R.I., ¼ H.P. S.P. and D.C.

| | | | |
|---|---|---|---|
| L105-1 | Stoca | 6 lbs. | 34.00 |
| L205-1 | Stocb | 6 lbs. | 34.00 |
| L405-1 | Stocd | 6 lbs. | 34.00 |
| L105-2 | Stoce | 6 lbs. | 27.00 |
| L205-2 | Stocg | 6 lbs. | 27.00 |
| L405-2 | Stocf | 6 lbs. | 27.00 |





## RELAYS

These relays include the latest features for magnetic switch design. Their application is extremely varied for starting and stopping motors at the command of a low voltage Thermostat or limit control in both the domestic and industrial field. Each relay is a self-contained unit. Those models used with low voltage Thermostats or limit controls include a transformer to provide the thermostat current. Standard model of each type of relay is for 110V. 60 Cy. except the R10-2 which is also standard in the 220V. 60 Cy. model.

Single Phase Relays: Electric Ratings: 10A. 110V.; 5A. 220V. A.C., 1 H.P. R.I., ½ H.P. S.P.
Type R12-1 (Series 10): Double pole double throw. Load and supply circuit separate.
Type R14-1 (Series 10): Single pole double throw. Load and supply circuit separate. D.C. Ratings: 5A. 110V.; 2½ A. 220V.; ¼ H.P.
Type R15-5 (Series 10): Single pole single throw.
Type R31-3 (Series 60): Single pole double throw. Load and supply circuit separate.
Type R32-1 (Series 30): Single pole double throw. Load and supply circuit separate.
Type R33-1 (Series 30): Double pole double throw. Load and supply circuit separate.

Polyphase Relays: Electric Ratings (except where specified otherwise): 15A. 110 or 220V. A.C., 5 H.P. 220V. 3 phase or 2 phase 4 wire, 3 H.P. 220V. 2 phase 3 wire, or single phase, 2 H.P. 110V. 3 phase or 2 phase 3 wire, 1½ H.P. 110V. single phase.
Type R10-2 (Series 10): Triple pole single throw. Two overload cutouts "uncooperated".
Type R15-4 (Series 10): Double pole single throw. Only suitable for single or 3 phase. Electric Ratings: 10A. 110V.; 5A. 220V. A.C., 1 H.P. R.I., ½ H.P. S.P. 3 phase, 1½ H.P.
Type R41-1 (Series 40): Triple pole single throw. Load and supply circuit separate.

**Single Phase**

| | | | |
|---|---|---|---|
| R12-1 | Rtask | 6½ lbs. | 32.00 |
| R14-1 | Rozxk | 6½ lbs. | 30.00 |
| R15-5 | Rvvxk | 6½ lbs. | 24.00 |
| R31-3 | Rygxk | 6 lbs. | 24.00 |
| R32-1 | Rngxk | 6½ lbs. | 32.00 |
| R33-1 | Rnjxk | 6½ lbs. | 35.00 |

**Polyphase**

| | | | |
|---|---|---|---|
| R10-2 | Rtexk | 12 lbs. | 50.00 |
| R15-4 | Ryoxk | 8 lbs. | 35.00 |
| R41-1 | Rpnxl | 8 lbs. | 28.00 |

# Mercury Switches

| DESCRIPTION | TYPE | CODE | SHIP WT |
|---|---|---|---|

## ELECTRODE-TO-MERCURY TYPE

The Electrode-to-Mercury type of Con-Tac-Tor Mercury Switches are designed for normal service having a current carrying capacity up to 10 amperes at 110 volts or to 5 amperes at 220 volts. This type of Mercury Switch consists of a glass envelope with seal-in electrodes and a quantity of mercury which makes and breaks contact with these electrodes to open and close the electrical circuit. Mercury Switches are being used in a number of different industries for a wide variety of applications. Because the proper selection of a Mercury Switch depends upon a number of conditions, it is impossible to give a full description here of its many features and successful applications.

Request for Prices and Detail Information Should Include Full Information as to the Proposed Application of the Mercury Switch

## MERCURY-TO-MERCURY TYPE

This type of Mercury Switch is designed for applications in which the ratings used range from 10 to 45 amperes 110 volts. Because of the heavier electrical load their construction differs somewhat. Within the glass envelope are sealed-in electrodes that are submerged beneath a quantity of mercury. In operation the two pools of mercury join or divide, making or breaking the electric circuit. The design of this type of switch is such that the arc formed occurs over the surface of a refractory or within a hard glass or quartz sleeve. In this type of Mercury Switch, in which the circuit is made or broken by the movement of two pools of mercury, there is a greater contact area which in turn results in greater current carrying capacity. Like the Electrode-to-Mercury type only the briefest information can be given here about this type of Mercury Switch.

Prices Quoted on Request

(See above)

# Patent Notice

Minneapolis-Honeywell and Iron Star Controls and Con-Tac-Tor Mercury Switches are manufactured and sold under the following patents either owned by Minneapolis-Honeywell Regulator Company or under which Minneapolis-Honeywell Regulator Company is licensed. Other U. S. and foreign patents are pending.

| | | | | | |
|---|---|---|---|---|---|
| No. Re 14,894* | No. 1,342,921 | No. 1,681,698 | No. 1,764,[illegible] | No. 1,811,[illegible] | No. 1,878,010 |
| Re 14,895* | 1,346,343 | 1,698,053 | 1,765,[illegible] | 1,813,[illegible] | 1,879,114 |
| Re 16,087 | 1,358,277 | 1,704,192 | 1,765,297 | 1,814,[illegible] | 1,880,124 |
| Re 16,140 | 1,359,186 | 1,705,116 | 1,768,805 | 1,815,[illegible] | 1,880,329 |
| Re 16,444 | 1,367,453 | 1,705,534 | 1,768,802 | 1,844,[illegible] | 1,880,830 |
| Re 17,993 | 1,368,476 | 1,705,537 | 1,768,940 | 1,845,[illegible] | 1,880,831 |
| Re 18,361 | 1,374,401 | 1,706,370 | 1,768,947 | 1,847,[illegible] | 1,880,833 |
| Re 18,505 | 1,385,486 | 1,706,903 | 1,768,948 | 1,847,[illegible] | 1,880,834 |
| Re 18,571 | 1,385,629 | 1,707,194 | 1,768,949 | 1,847,[illegible] | 1,880,837 |
| 1,202,618 | 1,398,824 | 1,707,195 | 1,770,879 | 1,848,[illegible] | 1,882,161 |
| 1,225,028 | 1,398,875 | 1,707,196 | 1,775,911 | 1,848,[illegible] | 1,882,511 |
| 1,228,029 | 1,398,876 | 1,707,650 | 1,776,108 | 1,848,[illegible] | 1,883,146 |
| 1,228,188 | 1,398,877 | 1,713,402 | 1,776,109 | 1,850,446 | 1,883,240 |
| 1,228,757 | 1,399,178 | 1,718,778 | 1,776,274 | 1,851,[illegible] | 1,883,241 |
| 1,239,598 | 1,401,299 | 1,716,911 | 1,777,181 | 1,851,[illegible] | 1,883,242 |
| 1,239,954 | 1,407,893 | 1,725,866 | 1,780,[illegible] | 1,851,[illegible] | 1,883,243 |
| 1,243,604 | 1,409,432 | 1,725,870 | 1,780,[illegible] | 1,851,[illegible] | 1,883,244 |
| 1,246,732 | 1,414,[illegible] | 1,725,[illegible] | 1,780,[illegible] | 1,851,[illegible] | 1,883,245 |
| 1,262,[illegible] | 1,420,806 | 1,727,[illegible] | 1,780,[illegible] | 1,851,[illegible] | 1,883,246 |
| 1,262,[illegible] | 1,422,[illegible] | 1,730,[illegible] | 1,781,[illegible] | 1,851,[illegible] | 1,883,247 |
| 1,262,[illegible] | 1,425,[illegible] | 1,730,[illegible] | 1,781,[illegible] | 1,851,[illegible] | 1,883,[illegible] |
| 1,322,[illegible] | 1,427,[illegible] | 1,730,[illegible] | 1,781,[illegible] | 1,851,[illegible] | 1,883,[illegible] |
| 1,331,[illegible] | 1,431,[illegible] | 1,730,[illegible] | 1,781,[illegible] | 1,851,[illegible] | 1,883,[illegible] |
| 1,335,[illegible] | 1,435,[illegible] | 1,730,[illegible] | 1,781,[illegible] | 1,851,[illegible] | 1,883,[illegible] |
| 1,351,[illegible] | 1,437,[illegible] | 1,734,[illegible] | 1,781,[illegible] | 1,851,[illegible] | 1,883,[illegible] |
| 1,362,[illegible] | 1,442,[illegible] | 1,736,[illegible] | 1,800,[illegible] | 1,851,[illegible] | 1,883,[illegible] |
| 1,369,[illegible] | 1,444,[illegible] | 1,736,[illegible] | 1,800,[illegible] | 1,851,[illegible] | 1,883,[illegible] |
| 1,401,[illegible] | 1,444,[illegible] | 1,739,[illegible] | 1,813,[illegible] | 1,851,[illegible] | 1,883,[illegible] |
| 1,402,[illegible] | 1,444,[illegible] | 1,739,[illegible] | 1,813,[illegible] | 1,851,[illegible] | 1,883,[illegible] |
| 1,409,[illegible] | 1,444,[illegible] | 1,739,[illegible] | 1,813,[illegible] | 1,851,[illegible] | 1,883,[illegible] |
| 1,414,[illegible] | 1,444,[illegible] | 1,739,[illegible] | 1,813,[illegible] | 1,851,[illegible] | 1,883,[illegible] |
| 1,417,[illegible] | 1,444,[illegible] | 1,739,[illegible] | 1,813,[illegible] | 1,851,[illegible] | 1,883,[illegible] |
| 1,417,[illegible] | 1,444,[illegible] | 1,739,[illegible] | 1,813,[illegible] | 1,851,[illegible] | 1,883,[illegible] |
| 1,418

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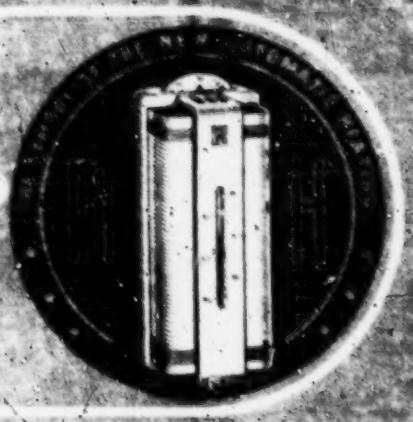
Defendant's Exhibit U

HONEYWELL

# AUTOMATIC

ST ★ ★ ★ ★

# CONTROLS



CONDENSED CATALOG

1940

# Automatic Coal Burner Controls

## STOKERSWITCHES▲

The Stokerswitch offers three distinct features in one unit—Holdfire Control—Outfire Control—High Temperature Cutoff. The Stokerswitch operates the stoker from stack temperature which is a true indication of fuel bed conditions. Therefore, the stoker operates only as often as the condition of the fire requires. The Outfire feature stops the stoker if the fire is extinguished from any cause or if the element temperature drops to approximately 95°. If the temperature of the Stokerswitch element becomes excessive, the High Temperature Cutoff feature interrupts the stoker operation for a short time increasing efficiency and reducing any tendency to pile up excessive fuel.

The L405A Stokerswitch, T42A or T44A Thermostat, R15A Relay and a two wire M-P Limit Control provides a fully satisfactory combination for D.C. Stokers within the rating of the relay. This includes D.C. motors up to and including ½ H.P. All models are equipped with a manual reset.

| Type | Ship. Wt. | List Price |
|---|---|---|
| L105A | 7 lbs. | $16.50 |
| L205A | 7 lbs. | 16.50 |
| L405A | 7 lbs. | 16.50 |

### SPECIFICATIONS

TYPES
L105A Stokerswitch—Series 10—Stack mounting
L205A Stokerswitch—Series 20—Stack mounting
L405A Stokerswitch—Series 40—Stack mounting

RANGE 135 to 315° F.

DIFFERENTIAL—Adjustable 20 to 150° F.

ELECTRICAL RATING—L105A, L205A low voltage L405A 10 amps. at 110 volts, 5 amps. at 220 volts 1 H.P., A.I., ½ H.P., S.P., ¼ H.P., D.C.

ELEMENT—8¾" to 9" insertion.

ADJUSTMENT MEANS—External lever at ⅞ of case.

LOCKING SCREW—Included on external lever to prevent tampering with setting.

DIMENSIONS—Height 6 ¼", width 4 ½", depth 13 ¼", depth of case 2¾".

*When Ordering Specify:*

1. Type Number.

*(PATENT NOTICE. These Stokerswitches carry with them a licensed right under patents pertaining exclusively to the fire control system of preventing extinguishment of the fire when operating under low heat requirement conditions as covered by Patent No. 1,758,140.)*

▲Trade Mark.

## STOKERTIMERS

The Type S400A Stokertimer is a moderately priced, yet efficient and reliable timing device for stokers. A simple synchronous motor rotates a cam which operates a mercury switch to provide the switching action for starting and stopping the stoker at the desired intervals. Simple adjustments are provided to permit suitable stoker "on" periods at hourly or half hourly intervals. The connection terminals are arranged to permit control of a separate load circuit if desired, i.e., a separate starter on a three phase line.

The Stokertimer is a line voltage device, and therefore is used in connection with a line voltage controller.

| Type | Ship. Wt. | List Price |
|---|---|---|
| S400A | 4 lbs. | $10.50 |

### SPECIFICATIONS

TYPES
S400A Stokertimer—Wall mounting—Has terminals for separate load circuit if desired.

VOLTAGE AND FREQUENCY—110 volts, 60 cycle standard. For 220 volts, 60 cycle and 110 or 220 volts, 25 cycle, add $2.00 list extra. Other semi-standard A.C. voltages and frequencies available add $2.00 list extra, but require approximately 6 weeks for delivery. On D.C. installations use Type L408 Stokerswitch and T42 or T45 Thermostat.

ELECTRICAL RATING—10 amps. 110 volts, 5 amps. 220 volts. 1 H.P., A.I., ½ H.P., S.P.

STANDARD TIMINGS—Timing adjustable from 1 to 7½ minutes at hourly or half hourly intervals.

DIMENSIONS—Height 4 ½", width 3 ¼", depth 3 ½".

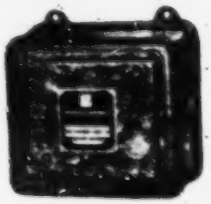
SPECIAL FEATURES AVAILABLE
Special Timing—
30 second to 3½ minute timing at 15 or 30 minute intervals (half of scale marking) on special order add $2.50 list extra.

*When Ordering Specify:*

1. Type Number.
2. Voltage and frequency.
3. Special features required.

## R183A STOKERELAY▲

The Stokerelay in a single, compact unit combines the functions of a relay and simple synchronous timing mechanism. Timing is fully and easily adjustable, and stoker operations of the desired length at either hourly or half hourly intervals are possible. The terminals are arranged to permit control of a separate load circuit if desired.



| Type | Ship. Wt. | List Price |
|---|---|---|
| R183A | 7 lbs. | $15.00 |

### SPECIFICATIONS

TYPES
R183A Stokerelay—Relay and timer—Wall mounting.

VOLTAGE AND FREQUENCY—110 volts, 60 cycle standard. 220 volts, 60 cycles add $2.00 list extra. 110-220 volts, 25 cycle add $6.00 list extra. Other semi-standard A.C. voltages and frequencies add $6.00 list extra, but require approximately 6 weeks for delivery. On D.C. installations use Type L405 Stokerswitch and T42 or T45 Thermostat.

ELECTRICAL RATING—10 amps. at 110 volts, 5 amps. at 220 volts. 1 H.P., A.C.

STANDARD TIMINGS—Timings on all Stokerelays adjustable from ½ to 7½ minutes each half hour or hour as desired.

DIMENSIONS—Height 6 ⅝" width 6 ⅛" depth 3 ½".

SPECIAL FEATURES AVAILABLE—
Special Timings—
2 to 30 minutes timing out of 2 or 4 hour periods on special order at an extra cost.
15 second to 3 minute timing at 15 or 30 minute intervals (half of scale marking) on special order add $2.00 list extra.

*When Ordering Specify:*

1. Type Number.
2. Voltage and frequency.
3. Special features required.

| THERMOSTATS AND HEATERS THAT MUST BE USED WITH THIS STOKERELAY | |
|---|---|
| | 110 or 220 Volts 25 or 60 Cycle |
| Types T11A, T109A, T111A and T178A | Green Coded Heater |
| Type T105A Chronotherm | Black and Green Coded Heater |

▲Trade Mark

NOTE. Single unit weights shown. Quantity shipment weights will be proportionately lower. Allow 4 to 6 weeks delivery on controls other than standard.

# Patent Notice

Minneapolis-Honeywell Controls, Time-O-Stat Controls and Con-Tac-Tor Mercury Switches and National Regulator Controls are manufactured and sold under the following patents either owned by Minneapolis-Honeywell Regulator Company or under which Minneapolis-Honeywell Regulator Company is licensed. Other U.S. and foreign patents are pending.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Re. 18,087 | 1,694,053 | 1,791,589 | 1,875,387 | 1,924,925 | 2,008,749 | 2,098,808 | 2,144,587 | 2,177,602 |
| Re. 18,140 | 1,694,107 | 1,793,101 | 1,875,388 | 1,925,455 | 2,008,776 | 2,099,687 | 2,145,146 | 2,178,825 |
| Re. 18,444 | 1,700,318 | 1,793,230 | 1,875,909 | 1,925,781 | 2,013,269 | 2,100,284 | 2,145,199 | 2,179,044 |
| Re. 17,993 | 1,703,534 | 1,795,149 | 1,875,910 | 1,926,880 | 2,017,368 | 2,101,548 | 2,145,791 | 2,179,700 |
| Re. 18,381 | 1,703,537 | 1,798,288 | 1,875,911 | 1,927,038 | 2,019,671 | 2,101,808 | 2,148,127 | 2,180,503 |
| Re. 18,503 | 1,704,008 | 1,798,511 | 1,875,989 | 1,927,848 | 2,019,945 | 2,102,324 | 2,148,804 | 2,180,675 |
| Re. 18,771 | 1,704,370 | 1,798,544 | 1,875,989 | 1,929,606 | 2,020,168 | 2,104,972 | 2,148,880 | 2,180,764 |
| Re. 19,091 | 1,704,371 | 1,800,412 | 1,876,044 | 1,931,238 | 2,021,407 | 2,105,688 | 2,148,681 | 2,180,800 |
| Re. 19,235 | 1,705,527 | 1,805,277 | 1,876,135 | 1,931,663 | 2,021,413 | 2,105,898 | 2,147,274 | 2,181,061 |
| 1,458,749 | 1,707,193 | 1,809,827 | 1,877,037 | 1,935,909 | 2,022,186 | 2,107,077 | 2,147,804 | 2,181,423 |
| 1,460,138 | 1,707,194 | 1,810,172 | 1,877,278 | 1,937,746 | 2,023,740 | 2,108,770 | 2,148,866 | 2,181,427 |
| 1,467,049* | 1,707,195 | 1,813,732* | 1,877,327 | 1,937,929 | 2,023,748 | 2,108,776 | 2,149,542 | 2,183,874 |
| 1,484,156 | 1,707,459 | 1,816,881 | 1,877,605 | 1,937,988 | 2,025,097 | 2,109,082 | 2,150,117 | 2,184,613 |
| 1,491,156 | 1,713,402 | 1,818,548 | 1,878,010 | 1,940,718 | 2,025,264 | 2,109,862 | 2,151,040 | 2,184,701 |
| 1,493,739 | 1,713,773 | 1,818,697 | 1,879,154 | 1,941,503 | 2,025,542 | 2,109,939 | 2,151,050 | 2,184,703 |
| 1,498,928 | 1,718,775 | 1,820,300 | 1,880,524 | 1,941,940 | 2,028,110 | 2,110,049 | 2,152,843 | 2,188,438 |
| 1,501,943 | 1,718,951 | 1,826,570 | 1,880,829 | 1,941,948 | 2,029,465 | 2,112,218 | 2,154,041 | 2,188,542 |
| 1,533,630 | 1,725,868 | 1,826,571 | 1,880,830 | 1,943,899 | 2,029,513 | 2,112,397 | 2,154,051 | 2,188,563 |
| 1,537,921 | 1,725,878 | 1,826,572 | 1,880,831 | 1,943,988 | 2,029,615 | 2,114,704 | 2,154,511 | 2,188,635 |
| 1,543,418 | 1,727,308 | 1,826,993 | 1,880,832 | 1,948,788 | 2,032,668 | 2,114,981 | 2,154,523 | 2,188,775 |
| 1,543,445 | 1,727,735 | 1,827,971 | 1,880,871 | 1,946,903 | 2,036,868 | 2,114,983 | 2,154,844 | 2,188,808 |
| 1,544,343 | 1,730,828 | 1,827,972 | 1,881,637 | 1,949,210 | 2,037,571 | 2,116,606 | 2,154,858 | 2,188,865 |
| 1,556,277 | 1,730,829 | 1,827,340 | 1,881,984 | 1,951,883 | 2,038,067 | 2,116,801 | 2,155,358 | 2,188,877 |
| 1,559,186 | 1,730,830 | 1,829,553 | 1,882,341 | 1,953,425 | 2,039,910 | 2,116,802 | 2,155,984 | |
| 1,567,438 | 1,730,831 | 1,831,845 | 1,883,015 | 1,956,783 | 2,041,050 | 2,117,081 | 2,157,329 | Des. 85,552 |
| 1,569,474 | 1,732,174 | 1,832,462 | 1,883,146 | 1,957,085 | 2,041,363 | 2,117,514 | 2,158,059 | Des. 86,681 |
| 1,571,401 | 1,734,017 | 1,835,307 | 1,883,240 | 1,958,081 | 2,041,645 | 2,117,768 | 2,159,284 | Des. 96,822 |
| 1,572,498 | 1,738,129 | 1,838,974 | 1,883,241 | 1,958,093 | 2,041,821 | 2,118,888 | 2,159,503 | |
| 1,583,586 | 1,738,141 | 1,838,152 | 1,883,242 | 1,960,689 | 2,045,790 | 2,119,503 | 2,159,513 | |
| 1,585,629 | 1,738,150 | 1,839,630 | 1,883,243 | 1,961,252 | 2,048,162 | 2,119,944 | 2,159,617 | |
| 1,593,581 | 1,738,318 | 1,843,801 | 1,883,244 | 1,961,778 | 2,048,653 | 2,120,427 | 2,159,634 | |
| 1,598,874 | 1,744,189 | 1,844,938 | 1,883,245 | 1,961,802 | 2,052,536 | 2,120,803 | 2,159,951 | |
| 1,598,875 | 1,745,178 | 1,845,227 | 1,883,246 | 1,962,508 | 2,052,537 | 2,120,837 | 2,160,800 | |
| 1,598,876 | 1,745,840 | 1,847,033 | 1,883,247 | 1,962,520 | 2,052,918 | 2,120,938 | 2,160,042 | |
| 1,598,877 | 1,747,153 | 1,847,034 | 1,883,248 | 1,963,957 | 2,052,939 | 2,121,321 | 2,166,400 | |
| 1,599,173 | 1,749,828 | 1,847,035 | 1,883,957 | 1,968,106 | 2,052,947 | 2,122,887 | 2,181,248 | Canadian Patents |
| 1,605,296 | 1,751,544 | 1,847,036 | 1,885,439 | 1,968,395 | 2,052,987 | 2,123,428 | 2,181,258 | No. 238,347 [1924] |
| 1,607,362 | 1,752,149 | 1,847,037 | 1,893,238 | 1,969,136 | 2,054,331 | 2,123,283 | 2,181,992 | 248,704 [1925] |
| 1,609,432 | 1,752,840 | 1,847,038 | 1,893,875 | 1,969,981 | 2,054,368 | 2,125,648 | 2,182,737 | 255,926 [1925] |
| 1,614,583 | 1,758,146* | 1,847,880 | 1,899,254 | 1,969,987 | 2,055,033 | 2,126,182 | 2,186,602 | 285,315 [1928] |
| 1,630,806 | 1,758,147* | 1,848,087 | 1,899,744 | 1,969,988 | 2,059,635 | 2,126,384 | 2,187,227 | 292,948 [1929] |
| 1,632,112 | 1,760,382 | 1,848,653 | 1,901,070 | 1,969,974 | 2,063,998 | 2,126,914 | 2,189,141 | 297,015 [1930] |
| 1,635,796 | 1,763,093 | 1,850,448 | 1,902,173 | 1,970,987 | 2,064,193 | 2,127,472 | 2,189,168 | 305,083 [1930] |
| 1,637,880 | 1,763,094 | 1,852,333 | 1,902,481 | 1,970,988 | 2,064,194 | 2,127,880 | 2,189,698 | 305,601 [1930] |
| 1,651,404 | 1,764,346 | 1,853,194 | 1,902,482 | 1,972,291 | 2,064,231 | 2,129,272 | 2,170,072 | 324,363 [1932] |
| 1,660,993 | 1,765,056 | 1,853,195 | 1,905,414 | 1,973,620 | 2,065,835 | 2,132,292 | 2,170,232 | 324,364 [1932] |
| 1,661,638 | 1,765,207 | 1,853,196 | 1,905,771 | 1,974,060 | 2,065,841 | 2,132,323 | 2,170,310 | 324,365 [1932] |
| 1,661,830 | 1,766,808 | 1,853,431 | 1,907,093 | 1,974,065 | 2,065,844 | 2,132,513 | 2,170,389 | 330,554 [1933] |
| 1,662,524 | 1,766,893 | 1,854,207 | 1,908,009 | 1,978,705 | 2,066,413 | 2,134,940 | 2,170,497 | 333,959 [1933] |
| 1,664,398 | 1,768,940 | 1,854,519 | 1,908,493 | 1,978,737 | 2,070,118 | 2,135,991 | 2,171,272 | 336,159 [1933] |
| 1,664,840 | 1,768,941 | 1,854,540 | 1,908,494 | 1,979,690 | 2,072,025 | 2,136,336 | 2,171,273 | 336,160 [1933] |
| 1,664,328 | 1,768,943 | 1,855,415 | 1,908,496 | 1,985,218 | 2,073,384 | 2,136,695 | 2,172,440 | 353,990 [1935] |
| 1,668,801 | 1,768,948 | 1,855,741 | 1,910,721 | 1,985,216 | 2,073,346 | 2,137,550 | 2,172,487 | 354,695 [1935] |
| 1,671,910 | 1,770,479 | 1,856,077 | 1,911,773 | 1,986,597 | 2,075,289 | 2,138,483 | 2,172,820 | 357,985 [1936] |
| 1,673,057 | 1,773,817 | 1,856,586 | 1,912,791 | 1,988,809 | 2,076,518 | 2,138,788 | 2,173,331 | 361,552 [1936] |
| 1,673,083 | 1,774,108 | 1,859,934 | 1,914,435 | 1,988,877 | 2,076,788 | 2,138,791 | 2,173,798 | 363,994 [1937] |
| 1,678,131 | 1,774,109 | 1,861,046 | 1,916,814 | 1,989,278 | 2,080,718 | 2,138,792 | 2,173,799 | 364,824 [1937] |
| 1,678,920 | 1,774,278 | 1,862,373 | 1,918,779 | 1,989,972 | 2,080,836 | 2,138,798 | 2,173,801 | 336,420 [1937] |
| 1,678,922 | 1,776,143 | 1,862,383 | 1,918,794 | 1,990,216 | 2,081,091 | 2,140,451 | 2,173,809 | 366,421 [1937] |
| 1,678,923 | 1,780,302 | 1,862,394 | 1,918,805 | 1,990,813 | 2,083,932 | 2,140,473 | 2,173,810 | 369,978 [1937] |
| 1,678,202 | 1,780,312 | 1,863,641 | 1,918,337 | 1,991,891 | 2,083,612 | 2,140,488 | 2,174,910 | 370,112 [1937] |
| 1,680,049 | 1,780,313 | 1,871,672 | 1,920,757 | 1,991,807 | 2,083,780 | 2,141,208 | 2,174,443 | 378,095 [1938] |
| 1,680,263 | 1,780,990 | 1,872,147 | 1,920,998 | 1,993,282 | 2,086,037 | 2,141,244 | 2,175,720 | 378,096 [1938] |
| 1,680,348 | 1,782,530 | 1,872,223 | 1,921,196 | 1,993,687 | 2,089,181 | 2,142,059 | 2,175,741 | 378,442 [1938] |
| 1,683,408 | 1,783,474 | 1,872,880 | 1,922,201 | 1,997,559 | 2,089,826 | 2,143,076 | 2,176,009 | 378,754 [1938] |
| 1,685,286 | 1,783,730 | 1,874,116 | 1,923,294 | 1,999,053 | 2,093,649 | 2,143,351 | 2,177,498 | 381,293 [1938] |
| 1,686,121 | 1,785,741* | 1,874,117 | 1,924,304 | 2,000,700 | 2,094,992 | 2,143,356 | 2,177,596 | 384,010 [1939] |
| 1,690,881 | 1,787,700 | 1,874,611 | 1,924,908 | 2,003,634 | 2,098,323 | 2,143,569 | 2,177,597 | 388,107 [1939] |

*The right to use the Systems protected by the following patents is only granted to the user by Minneapolis-Honeywell Regulator Company when the particular controls as shown below are purchased from Minneapolis-Honeywell Regulator Company and used in the Systems:

| Patent No. | SYSTEM | CONTROLS |
|---|---|---|
| 1,467,049 | Diaphragm Gas Valve System | Any Main Fuel Valve or Safety Pilot |
| 1,758,146 | System of maintaining Stoker Fire | ▲Stokerswitches |
| 1,758,147 | System of maintaining Stoker Fire | ▲Holdfire Controls |
| 1,785,741 | Humidifying System | Humidity Responsive Controls |
| 1,813,732 | Forced Air Furnace Control System | Furnace Fan Controls |

▲Trade Mark

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

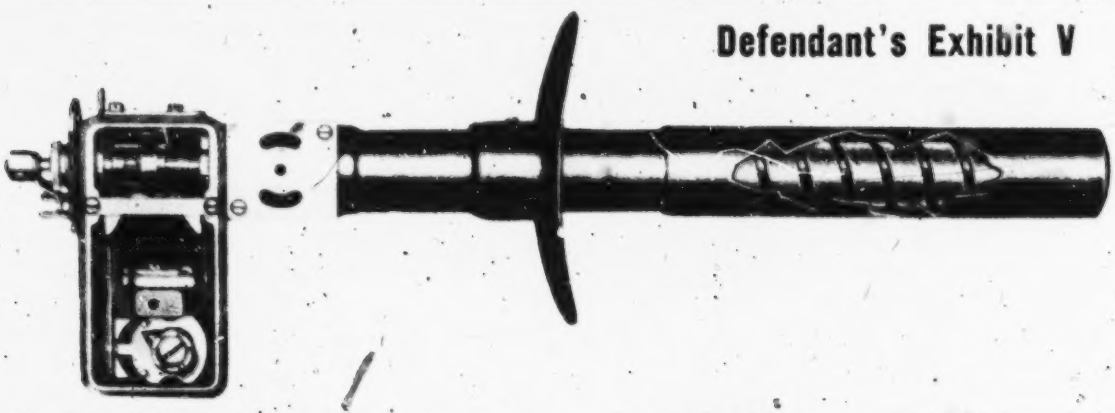
# Penn Stoker Control

## Type J, Model JHF

### Hold Fire Switch With Out Fire Lockout

Manufactured by PENN ELECTRIC SWITCH CO. Des Moines, Iowa

**Defendant's Exhibit V**



The Type J, Model JHF is a dual stoker switch designed for installation in the stack to prevent the fire from going out on mild days when the room thermostat will not normally close often enough to maintain a fire in the combustion chamber.

In addition to functioning as a hold fire switch an added feature has been incorporated to shut down the stoker in case the fire goes out, preventing automatic operation until the fire has been restarted and the control manually reset. Two separate contact structures are used, both being operated by the flexing of the helix due to changes in stack temperatures. The main, or hold fire contacts, are connected in parallel with the line voltage room thermostat and the auxiliary, or out fire contacts, are wired in series with the stoker motor.

An outside adjuster is conveniently located for adjusting the opening and closing points of the hold fire switch which should be determined for each individual installation. The out fire, or auxiliary contacts, are factory adjusted to open approximately 30 degrees under the closing point of the hold fire contacts. This insures a complete shut down in event the fire goes completely out, eliminating any possible chance of the combustion chamber being filled with unburned coal. The bimetal helix is protected from excessive stack temperatures by a suitable covering which also prevents corrosion of the helix.

A suitable curved flange for stack mounting is furnished as standard. Flat surface mounting flanges are available on request.

— SPECIFICATIONS —

**ELECTRICAL RATING:**
1/3 H.P. D.C.
1/4 H.P. A.C. R.I.
1/6 H.P. A.C. Split Phase.
Maximum voltage—250.

**RANGE—Adjustable:**
100 to 500 degrees.
For Maximum Stack Temperature of 1100° F.

**HOLD FIRE DIFFERENTIAL—Adjustable:**
85° min. to 400° max.

**OUT FIRE DIFFERENTIAL—Non-adjustable:**
Operates 30° under closing point of hold fire switch.

**ELECTRICAL CONNECTIONS:**
Three terminal posts in conduit box provided.

**MOUNTING:**
In any position. In collar provided with switch frame downward preferred.

**SHIPPING WEIGHT:**
Approximately 8 pounds.

**DIMENSIONS:**
3 1/4" x 17" x 4 1/4".

Listed as Standard by Underwriters' Laboratories, Inc., Chicago, Illinois

**LIST PRICE — $22.00**

Price Subject to Change Without Notice

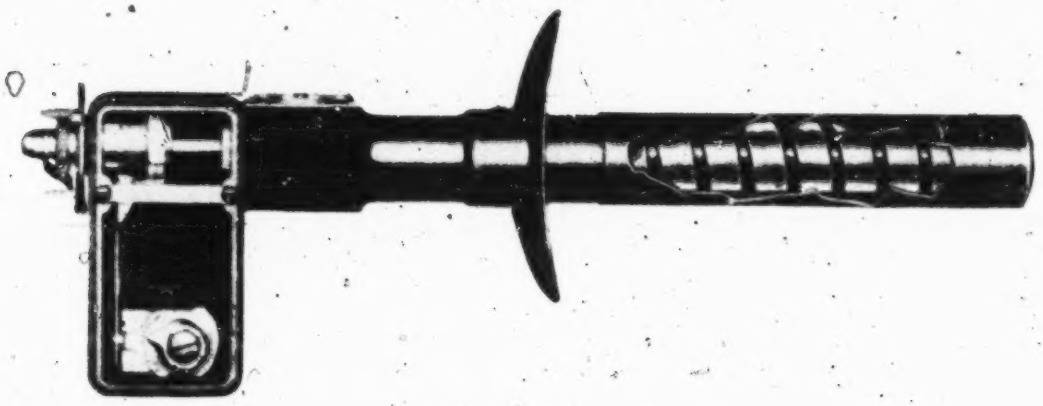
600

# Penn Stoker Control

## Type J, Model JRHS

### Hold Fire Stoker Switch

Manufactured by PENN ELECTRIC SWITCH CO. Des Moines, Iowa



The Type J, Model JRHS Stoker Control is similar in design to the Model JHF described on the preceding page, except that the out fire lockout feature has been omitted.

Operating in parallel with the room thermostat this switch starts and stops the stoker at intervals according to stack temperature, maintaining sufficient fire in the combustion chamber on mild days when the room thermostat does not operate often enough to keep the fire from going out and filling the chamber with unburned coal.

This device is fully adjustable over a range of from 100-500 degrees, making the control extremely flexible and insuring satisfactory operation regardless of outside temperature conditions.

— SPECIFICATIONS —

**ELECTRICAL RATING**
1 3/4 H.P. D.C.
1/2 H.P. A.C. R.I.
1/6 H.P. A.C. Split Phase.
Maximum voltage—250.

**RANGE**—Adjustable:
100 to 500 degrees.
For maximum stack temperature of 1100° F.

**DIFFERENTIAL**—Adjustable
55° min. to 400° max.

**MOUNTING:**
In any position. In collar provided with switch frame downward, preferred.

**ELECTRICAL CONNECTIONS:**
Two terminal posts in conduit box provided.

**SHIPPING WEIGHT:**
Approximately 8 pounds.

**DIMENSIONS:**
3 1/8" x 17" x 6 1/8".

Listed as Standard by Underwriters' Laboratories, Inc., Chicago, Illinois

LIST PRICE — $14.00

Price Subject to Change Without Notice



(Printed in U.S.A.)

ESTABLISHED 1855

# THE BROWNELL COMPANY

MANUFACTURERS OF
RIVETED AND WELDED STEEL BOILERS
UNDERFEED STOKERS
MAIN OFFICE AND WORKS
DAYTON, OHIO

SEVENTY FIFTH ANNIVERSARY 1855 1930

**Defendant's Exhibit X**

July 2, 930

Mercold Corp.,
4201 Belmont Ave.,
Chicago, Ill.

Gentlemen:

We are at the present time running a test on a small domestic stoker which uses a 1/4 H.P., 220 volt A.C. 60 cycle single phase motor.

We are desirous of securing a stack control with as great a range as possible, one that operates on the temperature of the flue gases in the stack. If desired, this could be connected across the line direct to the motor. Will you please advise just what you have to offer, price and delivery; also as stated above, the greatest range in temperature or the different ranges that you can control.

We would also especially state that this instrument should close on the fall of temperature and open on the rise of temperature. This is necessary. Awaiting your prompt advices, we are

Yours very truly,

THE BROWNELL COMPANY

CE: A

Chas. E. Ireland,
Purchasing Agent.

July 7, 1930

The Brownell Company
Dayton, Ohio

Gentlemen:

Attention: Mr. Wieland

In reply to your favor of July 2nd, we are enclosing bulletin describing our M-51 control which could be used under the conditions stated in your letter, providing the maximum temperature of the stock does not exceed 900 degrees.

In a single pole type this control takes a list price of $18.00 subject to your regular discount.

The above control has a range of from 50 to 650 degrees and can be adjusted to cut in and out at any positions within these figures.

Trusting that this gives you the desired information and thanking you for your many past favors, we are

Very truly yours,

THE MERCOID CORPORATION

HAM:GH

H.A. Matthews, Sales Engr.

ESTABLISHED 1855

THE BROWNELL COMPANY

MANUFACTURERS OF
RIVETED AND WELDED STEEL BOILERS
UNDERFEED STOKERS
MAIN OFFICE AND WORKS
DAYTON, OHIO

CODES
WESTERN UNION
UNIVERSAL FIVE LETTER

SEVENTY FIFTH ANNIVERSARY 1855 1930

Aug. 13, 1930.

Mercoid Corp.,
4201 Belmont Ave.,
Chicago, Ill.

18 10 +

Gentlemen:

Referring to your Figure M-51 furnace control, one of which was shipped to us last month for experimental purposes, find that there is a possibility of us using these in fairly large quantities. If we should adopt this control for use in connection with one of our small stokers would be able to use at least 500 and possibly 1000 of them within a year. We would, therefore, suggest that based upon a quantity of 500 to be taken out in lots of 25 within a period of one year that you let us have your rock bottom price.

Yours very truly,

THE BROWNELL COMPANY

CH:MA

Chas. L. Fifield,
Purchasing Agent.

August 14,1930

The Brownell Co.,
Dayton, Ohio.

Attention Mr. Chas. M. Wieland, P. A.

Gentlemen:

We are in receipt of your favor of August 13th and are pleased to note the M-51 Furnace Type of Control for stoker application meets with your approval.

The list price of this control in the single pole type is $18.00, and we are pleased to quote you a discount of 50-10 in lots of 25 or more in a shipment.

We are also pleased to make a further proposal not only on your Type M-51 Control requirements, but to include any other Mercoid Controls purchased during the year, so that in the event of your purchasing 100 or more controls in the course of a year, an additional 1% discount will be credited to your account, on 200 controls 2%, and so on up to 1,000 controls, making a total discount of 20-10-10% in the event of 1,000 controls being purchased over a period of one year.

We have discussed with our Engineering Department the application of the M-51 Control on stokers and we are prepared to furnish a special stem, should this be necessary.

We would be interested in hearing from you as to the results obtained with the standard type of mounting, also as to just what modifications you would suggest in order to completely adapt this control to fully meet your requirements.

Trusting we may hear further from you in connection with the above, we remain

Yours very truly,

J Or[illegible] VICE PRESIDENT.

9-8 I M.

ESTABLISHED 1855

THE BROWNELL COMPANY

MANUFACTURERS OF
RIVETED AND WELDED STEEL BOILERS
UNDERFEED STOKERS

ADDRESS ALL COMMUNICATIONS TO THE COMPANY

CODES
WESTERN UNION
UNIVERSAL FIVE LETTER

MAIN OFFICE AND WORKS
DAYTON, OHIO

SEVENTY FIFTH ANNIVERSARY 1855 1930

Sept. 5, 1930

ercoid Corp.,
4201 Belmont Ave.,
Chicago, Ill.

Gentlemen:

Referring to the M-51 furnace control recently shipped us, will state that it has given fairly good results, but if we can obtain same with certain improvements, believe it would meet our entire requirements.

We desire a control to cut in at approximately 150 deg. and to cut out between 250 and 600 deg. The cut out to be adjustable and in addition to take care of any possible break in current, would desire it to cut out on a light temperature say 100 deg. and stay out until reset by hand.

Is it possible for you to furnish a control of this type? Please advise promptly.

Yours very truly,

THE BROWNELL COMPANY

Chas. E. Wieland,
Purchasing Agent.

CEW:MA

606

ak 9/30

September 3, 1930

The Brownell Company,
Dayton, Ohio,

Gentlemen:- Attention - Mr. Chas. E. Wieland, P.A.

We have your favor of the 5th, and wish to advise, when writing you under date of August 14th regarding the M-51 Furnace Control, we had in mind equipping this Control with the same type of stem that we employ in our M-1 Mercoid Pyratherm.

The M-53 Fan Control with a range of 50 to 600° would very easily take care of the intermittent operation of the stoker, cutting in at any point above 100° and cutting out at any higher point at which it would be set.

However, if a third operation was required to take care of any possible break in current, this would require an additional Control, which would be set at a point below the Control arranged for intermittent operation, so that the temperature in the stack dropping to the lower point, this instrument would act as a complete cut off requiring manual reset. The M-53 as supplied is fully automatic. When supplied semi-automatic with hand reset there is no extra charge.

Trusting this gives you the desired information, we remain

Yours very truly,

J:O:DS

VICE PRESIDENT

AMERICAN RADIATOR COMPANY
40 WEST 40TH STREET
NEW YORK
ACCESSORIES DIVISION

**Defendant's Exhibit Y**

June 18, 1929.

The Mercoid Corporation,
564 W. Adams Street.,
Chicago, Ill.

Gentlemen:-

Will you please send to:

The Cross Coal-O-Matic Stoker Company,
700 Baltimore Avenue.,
Kansas City, MO.

1 - cut of each of the following:
M-51 Furnace Control front view, same size as in your H-5 catalog.

Also one cut of Figure 37 hot water boiler control same size as in H-5 catalog.

Yours very truly,

ACCESSORIES DIVISION

C J Swan

Assistant Manager.

CJSwan/L

608

June 22, 1922

Cross Coal-O-Matic Stoker Co.
700 Baltimore Avenue
Kansas City, Mo.

Gentlemen:

We have a request from Mr. C. J. Swan of the American Radiator Company to forward to you one cut each of our Fig. M 51 and Fig. 57 controls as shown in our catalog of controls for heating equipment. You should receive these cuts within a few days.

If there is any further information of service you desire we will be glad to furnish it.

Yours very truly,

THE MERCOID CORPORATION

L. J. Schanz
Advertising Manager

Cross Coal & Wire
~~Sutter Co~~
700 Baltimore Ave.
Kansas City, Mo.

1 M 5 x Cut
1 Fig. 37 Cut.

SHIPPED
JUN 24 192
THE MERCOID CORPO

Defendant's Exhibit Z

CROSS COAL-O-MATIC COMPANY

DR WALTER M CROSS PRES
WALTER M CROSS JR SECY TREAS

700 BALTIMORE AVE
TELEPHONE MAIN 1388

KANSAS CITY, MO June 11, 1929.

The Merocid Corporation,
564 W. Adams St.,
Chicago, Ill.

Gentlemen:

We should like to have for our file a copy of your latest catalog and also prices and discounts to manufacturers.

We are contemplating quite an expansion in our stoker industry and may use your products quite extensively.

Thanking you, we are,

Very truly yours,

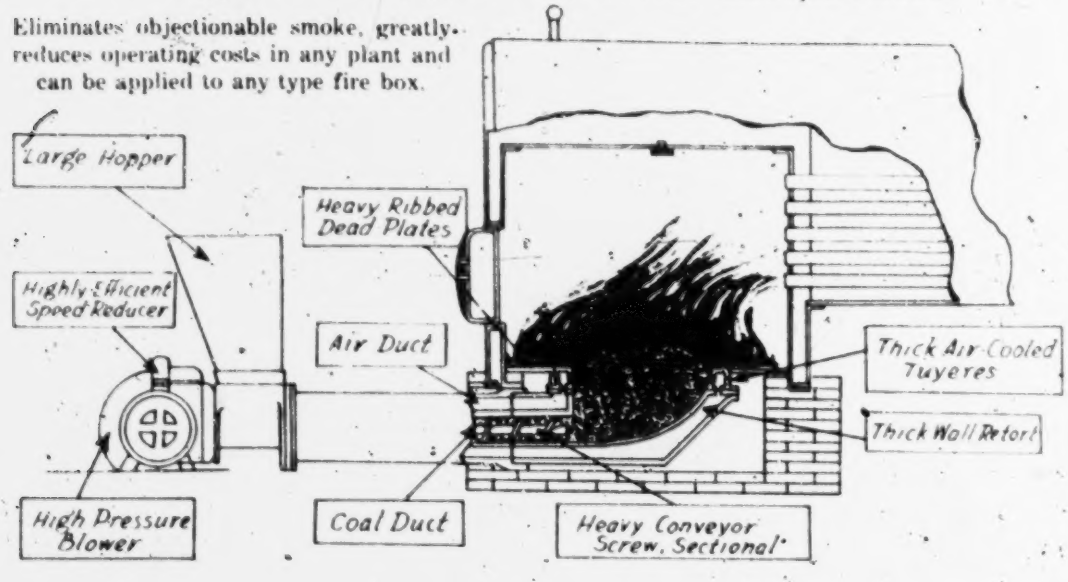
Walter M. Cross

WMC-B

# The Cross Coal-o-m
# Pa

## A Typical Cross Coal-o-matic Installation

Eliminates objectionable smoke, greatly reduces operating costs in any plant and can be applied to any type fire box.




## Table of Information

| Coal-o-matic Stoker | No. 2 | No. 3 | No. 4 |
|---|---|---|---|
| Lbs. Coal Fed Per Hr. Approximate Minimum | 50 | 80 | 150 |
| Lbs. Coal Fed Per Hr. Approximate Maximum | 150 | 325 | 575 |
| Hopper Capacity Lbs. Slack Coal | 280 | 490 | 800 |
| Length Overall, Inches | 87" | 101" | 136¼" |
| Average Projection from Boiler, Inches | 50" | 57" | 68" |
| Capacity Steam Radiation, Sq. Ft. | 4,500 | 10,000 | 16,000 |
| Capacity Hot Water Radiation, Sq. Ft. | 6,000 | 13,000 | 21,000 |

**60 Days Free Trial**

You are the sole judge of the efficiency and economy of the Cross Coal-o-matic Stoker. We will install the stoker and give you 60 days' free trial, in which time you are urged to test it in every way. At the end of the trial period you can buy the stoker for cash or on deferred payments, or we will take it out at our own expense if it fails to do as we represent.

# ıtic Stoker
# ys Large Dividends!

## 100 to 200% in 3 Years—

The Cross Coal-o-matic Stoker is efficient and economical. It combines comfort and convenience at greatly reduced operating costs, and will pay for itself in two or three years in fuel saving. This stoker burns slack, the cheapest kind of coal, and delivers the heat when and where you want it—without smoke.

## 7 Excellent Reasons Why
## You Need the Cross Coal-o-matic Stoker

**1** *Smokeless Firing--*

The Cross Coal-o-matic Stoker feeds coal to the bottom of the fire box continuously. Gases are driven through burning coals by a power-driven fan. This underfired principle and scientific air mixing burns all gases, and eliminates smoke.

**2** *Great Saving--*

Of, 15% to 50% by using slack, the cheapest kind of coal, and completely burning it. See page 4 of this bulletin for a 30-day test, showing saving of automatic stoker over hand fired boiler.

**3** *Low Initial Cost--*

This stoker can be applied to any type of fire box, without altering present equipment, at a surprisingly low cost. The saving in fuel will pay for the stoker in 2 or 3 years.

**4** *Perfect Automatic Control--*

Including low water cut-out, steam pressure and thermostat control. When desired temperature is reached, coal feeding stops until lower temperature starts motor.

**5** *Even Firing--*

By distributing firing evenly and continuously over a longer period of time and having a constant draft. The Cross Coal-o-matic Stoker forces fresh coal through burning coals a little at a time, maintaining an even fire.

**6** *Little Attention--*

No shaking of grates or stirring of fire. The fresh coal being forced from bottom of fire box pushes ashes to outer edge of grates. Fill hopper and remove clinkers when necessary.

**7** *Plenty of Heat--*

In mild or severe weather the Cross Coal-o-matic maintains the temperature you want. Coal feeding stops when desired temperature is reached, and begins when temperature falls.

# HERE'S *the* ANSWER WHEN *the* SMOKE INSPECTOR CALLS!

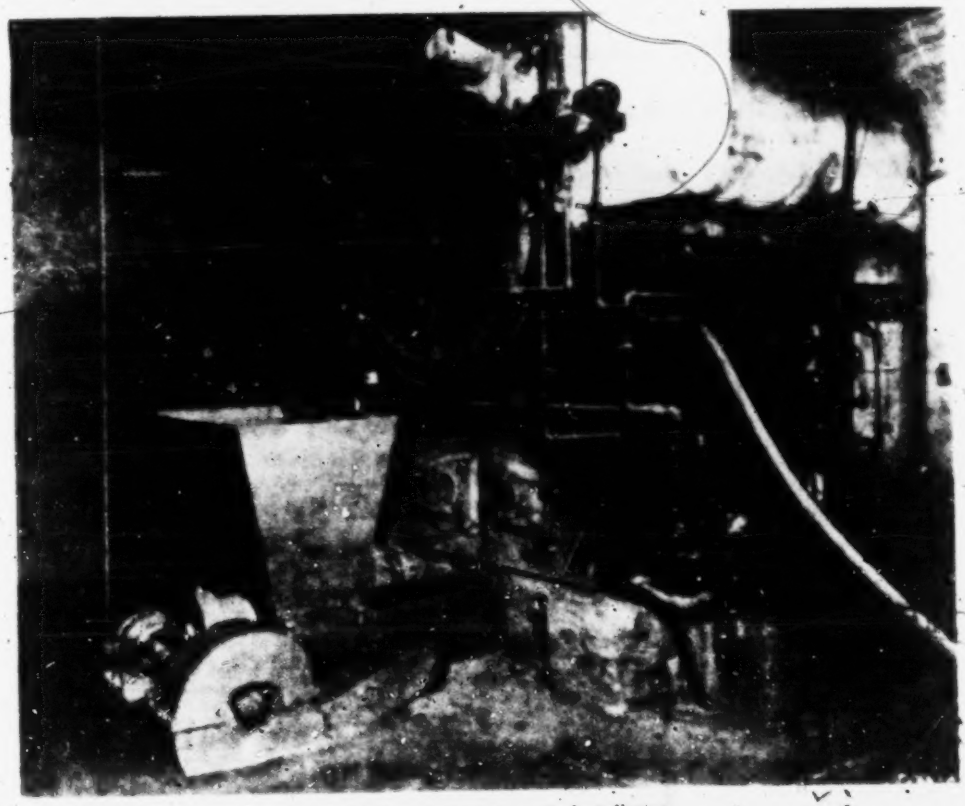
## Cross Coal-O-Matic Stokers

*for*

**OFFICE BUILDINGS**
**APARTMENTS**
**INDUSTRIAL USES**
**WAREHOUSES**

**GARAGES**
**BAKERIES**
**LAUNDRIES**
**CLEANING PLANTS**

Mr. Smoke Inspector knows he doesn't have to watch the chimney where an efficient stoker is working. The Cross Coal-o-matic Stoker feeds coal to your fire box continuously—the motor-driven fan provides quick ignition and complete combustion, without smoke—the automatic control insures an even temperature at all times.



A Typical Cross-Coal-o-matic Installation

## CROSS COAL-O-MATIC CO., Inc.

### AUTOMATIC COAL STOKERS

Manufactured in Kansas City

700 BALTIMORE AVE. KANSAS CITY, MO.

614

June 13, 1929

Cross Coal-O-Matic Co.
700 Baltimore Ave.
Kansas City, Mo.,

Gentlemen - Attention - Mr. Walter M. Cross

We have your favor of June 11th, and are pleased to enclose for your attention, copy of our new heating control catalog, together with copy of bulletin illustrating and describing our #48 double adjustment type controls.

The discount from all list prices shown in our heating catalog (with the exception of those shown on page 30 applying to Mercoid Tubes) and bulletin is 50%, and on an order for 25 or more assorted controls, the discount is 50-10%.

Trusting this gives you the desired information, and hoping that we may have an early opportunity of serving you, we remain

Yours very truly,
THE MERCOID CORPORATION

H.P:DS
Encls.

SALES ENGR.

CROSS COAL-O-MATIC COMPANY
WALTER M CROSS Pres
WALTER M CROSS Jr Sec & Treas
700 BALTIMORE AVE
TELEPHONE MAIN 1330

KANSAS CITY, MO October 22, 1929.

The Moreoid Corporation,
564 West Adams St.,
Chicago, Ill.

ENTERED D OCT 31 1929

Gentlemen:

With reference to your C.O.D. invoice 100270, of October 18, 1929, covering three controls, we beg to advise that these were for our account, although they were shipped to the American Engineering Company of Clinton, Iowa. We are therefore entitled to an additional 10% and will appreciate credit memorandum in the amount of $11.10.

We usually make these purchases through the American Radiator Company here, but they did not have the controls and could not have them shipped at once from Chicago, and we therefore placed the order direct with you.

Thanking you for your attention to this, we are,

Very truly yours,

CROSS COAL-O-MATIC COMPANY,

H. E. May

HEM-R

Cr Order your account
with 10% on your order
for 1 No 612 1 800
1 848 Motor Co
1 848 " 12 " Chase
Shipped to American Engineering Co
Clinton Iowa Invoice 100270 Rec your
letter 10/22

SHIPPING ORDER

# THE MERCOID CORPORATION

564 WEST ADAMS STREET
CHICAGO

N

10-31-29

CREDIT CROSS COAL-O-MATIC CO
700 BALTIMORE AVE
KANSAS CITY MISSOURI

ORDER NO 101392
CUST NO L-10-22-29

SHIPPED BY
—

CREDIT
OCT 31 1929
15017

TO

## RETURNED GOODS

WE CREDIT YOUR ACCOUNT WITH 10% ON YOUR ORDER FOR

1- NO 612
1- 848 MODEL A 1
1- 848 MODEL BA CHGED & SHIPPED TO
AMERICAN ENGINEERING CO CLINTON IOWA
ON OUR 100% TO SEE YOUR L-10-22-29

— NUMBER OF PKGS
WEIGHT
CHARGES

CROSS COAL-O-MATIC COMPANY

DR. WALTER M. CROSS, Pres.
WALTER M. CROSS, JR. Sec.-Treas.

[illegible] BALTIMORE AVE.
TELEPHONE MAIN 1338

KANSAS CITY, MO.

Nov. 26, 1929

The Mercoid Corporation
564 W. Adams St.
Chicago, Illinois

Attention: M.V. Costello

Gentlemen:

The writer has just returned from Mt. Carmel, Illinois, where you kindly wired him in reference to the Mercoid controls under date of November 21. We are sending to Mt. Carmel from here an 848 Model B Mercoid pressure control as you suggested.

We wish to thank you very much for the attention shown.

Yours very truly,

CROSS COAL-O-MATIC COMPANY

By [illegible]

PDC:DS

618

CROSS COAL-O-MATIC COMPANY

DR WALTER M CROSS Pres
WALTER M CROSS JR Sec'y Treas

700 BALTIMORE AVE
TELEPHONE MAIN 1530

KANSAS CITY MO

Feb. 11, 1930

The Mercoid Corporation
564 West Adams St.
Chicago, Illinois

Gentlemen:

We would be pleased to receive a few more copies of your most recent catalog. Also, if it is possible, we should like to receive cuts of the following controls which we use:

#845 Thermostat

#612118 Combination low water cutout and pressure control Range 0 - 8 lbs.

#846 B6 Pressure control

#758 Fig. 72 Low water cut out

#758 Fig. 71 Combination low water and pressure control of higher pressures

External Riserthern control

#848 G-1 Hot water temperature control

Thanking you, we are

Very sincerely,

CROSS COAL-O-MATIC COMPANY

BY Walter M Cross Jr

DS

619

On mail
as Mfg's Catalogs

# CROSS COAL-O-MATIC COMPANY

DR. WALTER M. CROSS, Pres.
WALTER M. CROSS, JR., Sec'y-Treas.

7425 PENN
TELEPHONE HARRISON 0000

KANSAS CITY, MO.

Aug. 14, 1930

The Mercoid Corporation
564 West Adams St.
Chicago, Illinois

Attention: L. J. Schans

Dear Sir:

We would appreciate it very much if you would quote us both our price and the list price on the following controls:

| Stock Number | Kind | Model | Standard Ranges |
|---|---|---|---|
| 845 | Thermostat for air temperature | | 56°- 80° |
| 845 | " " " " | | 38°- 60° |
| 848 | Pressure controls | | |
| 848 | Low pressure | A-1 | 1 to 15 lbs. |
| 848 | Vacuum | A-2 | 30" to 3" |
| 848 | Pressure and vacuum | A-3 | 10" to 10# |
| 848 | Pressure | B-1 | 10#- 60# |
| 848 | Pressure and vacuum | B-2 | 10"- 45# |
| 848 | " " " | B-3 | 30"- 35# |
| 848 | " | B-4 | 50 - 100# |
| 848 | " | B-6 | 0 - 200# |
| 848 | Vapor pressure | C | 1 oz.- 5# |
| 848 | Close vacuum control | D | 30"- 0" |
| 612 | Comb. low water cutout & pres.control | | 6 oz.- 10# |
| 848 | Temperature-straight connection | G-1 | 110°-220° |
| 848 | Temp. - back or angle connection | G-2 | 110°-220° |
| 848 | " - external pipe contact | G-3 | 110°-220° |
| 848 | " - straight connection | H-1 | All ranges |
| 848 | " - back or angle connection | H-2 | " " " |
| 848 | " - air temperature | K | 10 - 600° |
| 848 | " - " " | L | 10 - 600° |
| 848 | " - " " | M & N | 30 - 480° |
| 848 | " - " " | R & S | 15 - 245° |

Thanking you for this information at your earliest convenience, we are,

Yours very truly,

CROSS COAL-O-MATIC COMPANY

BY Walter M. Cross

WMCJr:DS

620

CROSS COAL-O-MATIC COMPANY

DR. WALTER M. CROSS, Pres. — [illegible] PENN
WALTER M. CROSS, JR., Sec'y-Treas. — TELEPHONE HARRISON [illegible]

KANSAS CITY, MO

Aug. 20, 1930

The Mercoid Corporation
Chicago, Illinois

Gentlemen:

We find that, with the use of small domestic stokers in hot air furnaces, a limit control both for top stack temperature limits ranging from say 200 - 250°, as well as low temperature limit control for fire boxes of say in the neighborhood of 100° are required. Will you please recommend and quote prices and discounts on the controls that we should use for these purposes? We will thank you for your early attention to this matter.

Also, we would appreciate duplicate copies of the various descriptive and service sheets for your various controls about which we asked in our recent letter. Are these available in quantities so that we might incorporate them into our service manuals for agents?

Very sincerely,

CROSS COAL-O-MATIC COMPANY

BY [illegible]

WMCJr:DS

for ack 9/18

August 28, 1930

Cross Coal-O-Matic Co.,
Kansas City, Mo.

Attention Mr. Walter M. Cross, Jr.

Gentlemen:

This will acknowledge receipt of your kind favor of August 20th and we are pleased to enclose our bulletin A-6 where you will note illustrated and described the M-51 Furnace Limit Control for top stack installation.

Regarding low temperature limit control, we recommend the use of the M-53 which is a double adjustment control, for both high and low operating temperatures, to meet a variety of conditions encountered in warm air furnace installations, and it will operate in such a manner that when the temperature drops to about 100° in the stack, the control will cut in and start the burner stoker. Both controls are recommended for stack installations.

We are pleased to quote as follows:

Discount of 50% in lots of less than $5, and 50-10% in lots of $5 or more, with the following proposal:

In the event of your ordering 100 or more assorted controls over a period of one year, an additional discount of 1% will be credited to your account. On a total of 200 controls, 2%, and so on up to 1000 controls, which would take an additional discount of 10%.

Regarding the second paragraph of your letter, we are forwarding you duplicate copies of our catalog and each of our bulletins pertaining to controls used in connection with domestic stokers. We will also be pleased to forward you any quantity of these catalogs for your service men, upon request.

Trusting this will give you the desired information, we remain

Very truly yours,
THE HERCOID CORPORATION
SALES ENGINEER

DFU:H Encl.

Cross-Coal-Bruster,

Kansas City Mo

att Walter Crane

14-6

2 - Bulletin #70

2 - 8 x 5 Circulars

2 - Bulletins ~~Aug 30~~.

Kiserthern

showing Aug 30 -

SHIPPED
AUG 30 1930
THE MERCOID CORPORATION

1 x 4

1 "

3 "

623

CROSS COAL-O-MATIC COMPANY

DR. WALTER M. CROSS, Pres.
WALTER M. CROSS, Jr., Sec'y-Treas.

1323 PENN
TELEPHONE HARRISON 0080

KANSAS CITY, MO

Aug. 22, 1930

Mr. Albert L. Schiff
The Marcoid Corporation
Chicago, Illinois

Dear Sir:

We wish to thank you very much for your letter of August 19th regarding prices and discounts.

Very sincerely,

CROSS COAL-O-MATIC COMPANY

BY Walter M. Cross

WMC Jr:DS

Att. 9-4 J.M.

CROSS COAL-O-MATIC COMPANY

DR. WALTER M. CROSS [illegible]
WALTER M. CROSS, JR. [illegible]

1323 PENN
TELEPHONE HARRISON [illegible]

KANSAS CITY, MO

September 2, 1930

10/4 S.

The Mercoid Corporation,
4201 Belmont Ave.,
Chicago, Ill.

Att: Mr. B. P. Werb, Jr.

Dear Sir:

We wish to thank you for your letter of August 28th enclosing recommendation for M-53 and the M-51 temperature control.

Very sincerely,

CROSS COAL-O-MATIC COMPANY

Walter M. Cross

WMC:Jr:S

CROSS COAL-O-MATIC COMPANY

DR. WALTER M. CROSS Pres.
WALTER M. CROSS, JR. Sec'y-Treas.

3323 PENN
TELEPHONE HARRISON 6000

KANSAS CITY, MO

Nov. 11, 1930

The Mereoid Corporation
4201 Belmont Ave.
Chicago, Illinois

Attention: Albert L. Schiff

Dear Sir:

We have your letter of November 6th.

We wish to advise that we are using and have been using for a period of a couple of years a good many of your controls, purchased through the American Radiator Company, of this city. We find this convenient, and it is our impression or understanding that our discounts from them and from you direct are the same. The American Radiator Company gives us very good service and we have dealt with them up to the present.

If any changes are advisable, we would be glad to consider same.

Very sincerely,

CROSS COAL-O-MATIC COMPANY

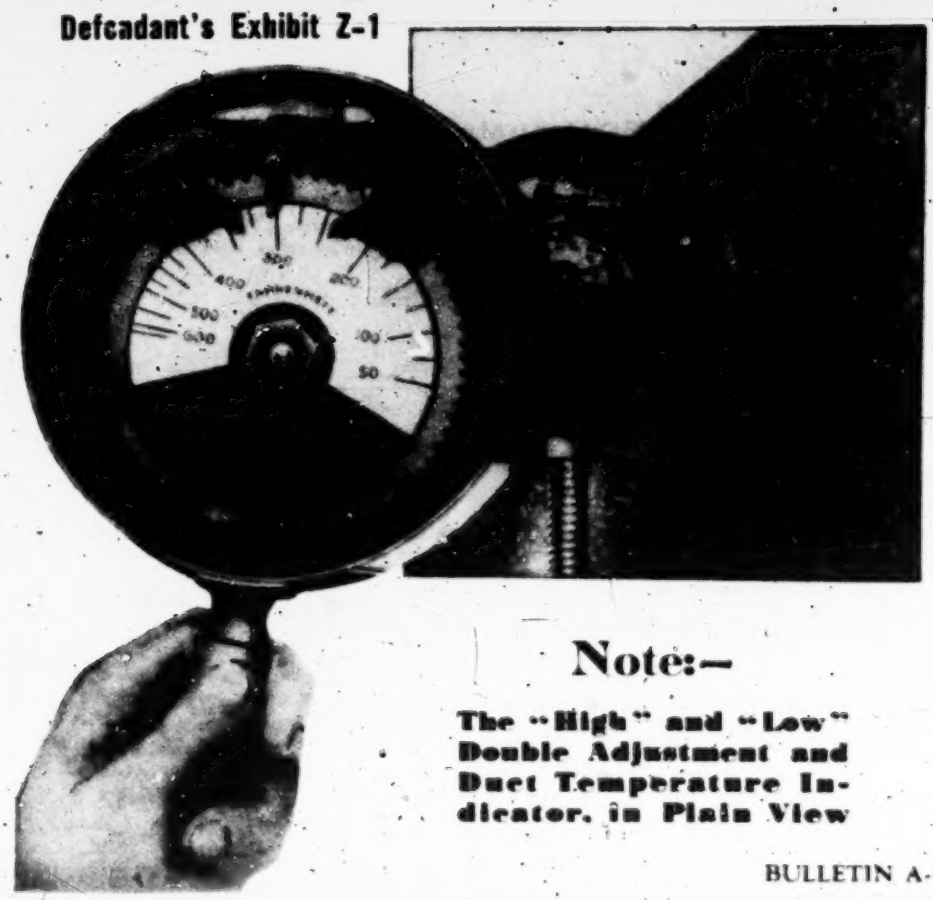
WMC Jr:DS

BY Walter M. Cross Jr.

626

# MERCOID M-53
## WARM AIR FURNACE FAN CONTROL

Defcadant's Exhibit Z-1



**Note:—**

**The "High" and "Low" Double Adjustment and Duct Temperature Indicator, in Plain View**

BULLETIN A-5


THE MERCOID CORPORATION

4201 BELMONT AVENUE

*Chicago, Illinois, U.S.A.*

25 CHURCH STREET
*New York, N. Y.*

1129 FOLSOM STREET
*San Francisco, Calif.*

*Cable Address "Mercoid" Chicago*


*Mercoid distributors are located in the larger cities of the United States, Canada, Great Britain, Denmark, Australia, New Zealand and other parts of the world*

Δ's Ex. Z-1

# Mercoid M-53 Warm Air Furnace Fan Control

**The Ideal Control for All Types of Booster Fan Applications. Sturdy in Construction. Reliable Performance. Indicates the Temperature in the Furnace Jacket. Meets practically all Operating Conditions. Its use is fully protected under Reissue Patent Number 15,531.**

(Additional Patent Nos. 1988874 [illegible] 1[illegible] others pending.)

THE efficiency of a warm air furnace is greatly increased through the use of a Mercoid controlled furnace fan, which operates economically, is convenient to adjust and saves fuel and time. It may be applied on any warm air furnace, where coal, oil or gas is used for fuel.

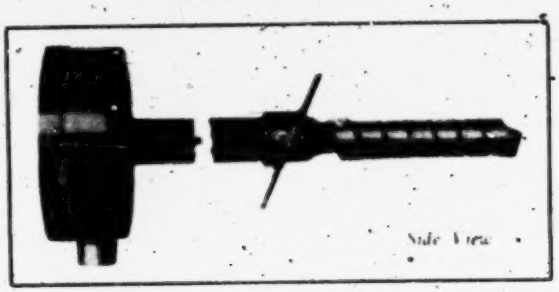
The Mercoid M-53 Warm Air Furnace Fan Control is neat in appearance and constructed to render dependable service.

It is equipped with the Mercoid Tipless Tube, the latest development in enclosed mercury contact switches.

The average furnace temperature range adjustment, on controls for booster fan application, is usually somewhere between 120 degrees and 150 degrees, but this may be varied to suit individual conditions. When the furnace delivers heat at a temperature of 150 degrees or higher, the fan starts and it continues to operate until the temperature drops to 120 degrees or less, when the fan will stop.

Where the hook-up includes a Mercoid room Thermostat the fan starts at the cut-in point of Control M-53, after the temperature in the furnace hood reaches 150 degrees. The thermostat in the room, if set at 68 to 70 degrees, will stop the fan when the room temperature rises to 70 degrees, and again start the fan when the temperature goes below 68 degrees, providing the temperature has not dropped below the cut-out point of the M-53 control, thus maintaining a uniform temperature. The M-53 control in this hook-up prevents the fan from blowing cold air in the rooms, if the furnace is not hot enough to deliver heat.

*Figure M-53*



Side View

The mechanism (in the M-53 Furnace Fan Control) has many outstanding features. It is unique in design and has the advantage of a simple double adjustment, for both "high" and "low" operating temperatures, to meet the variety of conditions encountered in warm air furnace installations.

The fluctuations in furnace temperatures, whether great or small, rapid or slow, are all met by means of this double adjustment feature. These fluctuations may be determined by means of the duct temperature indicator located over the dial, which also serves the purpose of a switch-tilting arm.

While the accuracy of the temperature indication will vary within certain limits, depending upon the adjustment of the control itself, it is sufficiently accurate for

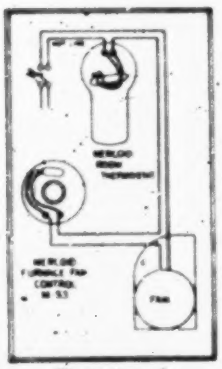


*Illustration 4*

*Simple diagram generally used for coal burning applications.*

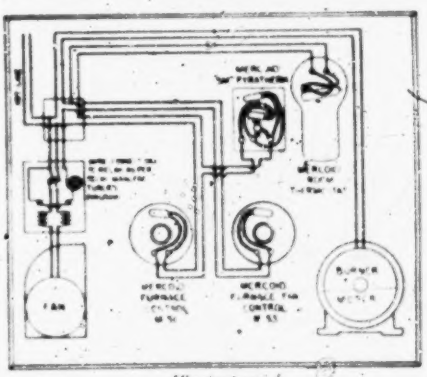


*Illustration 5*

*Diagram used, where the current capacity of the two motors exceeds 10 amperes, making it necessary to use a relay or magnetic starting switch.*

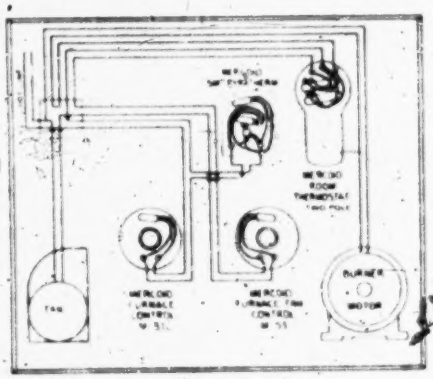


*Illustration 6*

*Diagram used where current capacity of each motor does not exceed 10 amperes, 110 volts. A single pole thermostat can be used when the combined motor load does not exceed 10 amperes, 110 volts.*

ordinary purposes) to enable the service man to check the proper size of fire. In this respect its usefulness is comparable to that of the thermometer on a hot water boiler or the pressure gauge on a steam plant.

The dial, located in the center of the instrument, is calibrated from 50 to 650 degrees Fahrenheit, in conformance with the physical characteristics of the bimetallic element which actuates the control. This element is designed so that it both operates the switch and indicates the temperature. Its novel construction permits the bimetallic element to resume its natural course after the switch has been thrown to "off" or "on" position.

Where used on furnaces heated by oil burners, the M-53 fan control usually employs additional controls on such equipment, as shown in the wiring diagrams, illustrations 5 and 6, and listed elsewhere.

Two types of flanges are available, permitting the instrument to be placed in almost any required position.

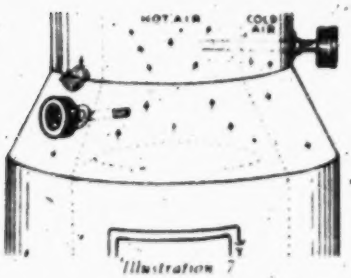


*Illustration 7*

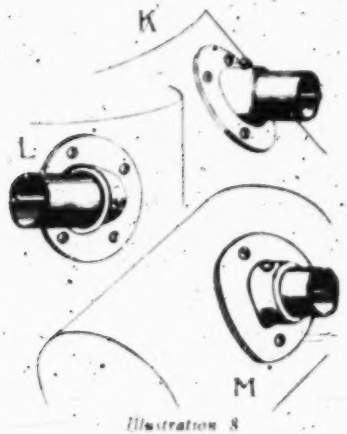


*Illustration 8*

The furnace type, regularly supplied, has a distinctive adjustment feature which enables the installer to place the instrument on the hood of a furnace where the angle is 45 degrees or less. At a 45 degree angle the instrument will project at a proper level with a radius directly from the center, as shown in "K" illustration 8 and on the left side of illustration 7. If the angle is less than 45 degrees the correct operating position may still be maintained by turning the flange until the stem of the instrument is horizontal and the face of the instrument parallel with the front of the furnace.

The stack type flange, furnished only when specified, is suitable for duct installation as shown in "M", illustration 8, or on an upright section of a furnace, as shown on the right side of a pipeless furnace, illustration 7.

Both types are made of steel and may be reshaped to fit different contours without any danger of breaking.

## MERCOID CONTROLS

The following controls may be used in conjunction with the M-53 control on certain types of installations.

### Mercoid Thermostat Figure 21

*Fig. 21*

The Mercoid Thermostat is designed to control an electric circuit through changes in room temperature. For warm air systems, equipped with booster fans, positive and reliable performance is assured by the use of the Mercoid Thermostat.

This instrument has been proven in service over a long period and has established a record for accurate unfailing performance.

STANDARD RANGE

50 degrees to 80 degrees Fahrenheit with 2 degrees operating differential.

| LIST PRICES | Fig. 21 |
|---|---|
| Single Pole | $30.00 |
| Two Pole | 36.00 |
| Two Circuit | 36.00 |
| For Special Range, add | 4.00 |

Where thermometer is specified on any of above types, add $2.00.

### Mercoid Furnace Control Figure M-51

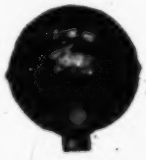


*Fig. M-51*

The M-51 Mercoid Furnace Control has been designed primarily to prevent the overheating of warm air furnaces in connection with automatic fuel burning systems. The construction of this control is similar to the M-53, with the exception that the position of the switch is reversed.

| Single Circuit | | PRICE LIST | | Single Pole | Dbl. Pole |
|---|---|---|---|---|---|
| M-51 | 10 amps. 110 v. | 5 amps. 220 v. | A.C. or D.C. | $18.00 | $24.00 |
| M-51A | 3 amps. 110 v. | 1½ amps. 220 v. | A.C. or D.C. | 16.00 | 18.00 |

### Mercoid Furnace Control Figure M-52

*Fig. M-52*

This control is supplied as a two circuit device for use with three wire systems where one circuit is required to be made and the other broken simultaneously.

| | | TWO CIRCUIT | | |
|---|---|---|---|---|
| M-52 | 10 amps. 110 v. | 5 amps. 220 v. | A.C. or D.C. | $24.00 |
| M-52A | 3 amps. 110 v. | 1½ amps. 220 v. | A.C. or D.C. | 18.00 |

### Mercoid Pyratherm Type SM

*Type SM*

The Mercoid Pyratherm Type SM is a complete stack safety control, combining two instruments in one. Type M Pyratherm Stack Safety Control and Type S Adjustatherm Safety Cutout. Designed for flue installation, providing protection against flame or ignition failure.

Used on burners having either constant ignition or constant gas pilot, or where the ignition is a separate feature.

| LIST PRICE | |
|---|---|
| Type SM Pyratherm with Adjustatherm | $30.00 |

### PRICE LIST M-53 FAN CONTROL

| | Single Circuit | | | Single Pole | Double Pole |
|---|---|---|---|---|---|
| M-53 | 10 amperes 110 volts | 5 amperes 220 volts | A.C. or D.C. | $18.00 | $24.00 |
| M-53X | 3 amperes 110 volts | 1½ amperes 220 volts | A.C. or D.C. | 16.00 | 18.00 |

Shipping weight, 4 lbs. 7 oz. Size, 16½" long overall. Diameter of case 4¾".

# Installation Instructions

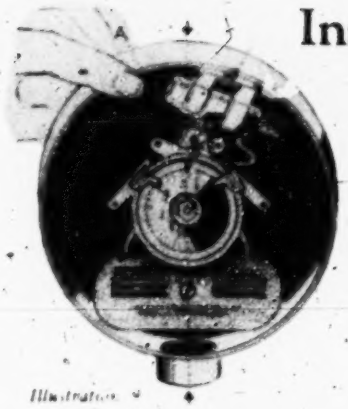



Illustration 9

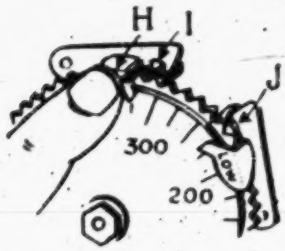
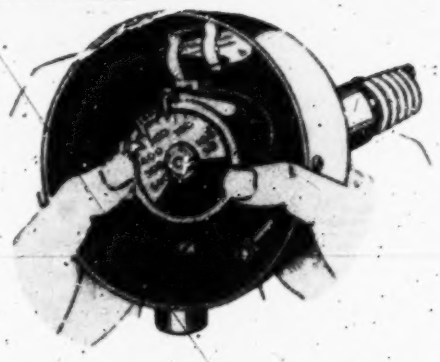



Illustration 10



All instruments should be handled carefully. After removing all packing material note tag warning not to twist the bimetallic element. To do so might distort the metal and disarrange the adjustment which was correctly made at the factory.

Care should be given in selecting a proper location for both appearance and operation. Do not locate bimetallic element closer than three inches from the dome.

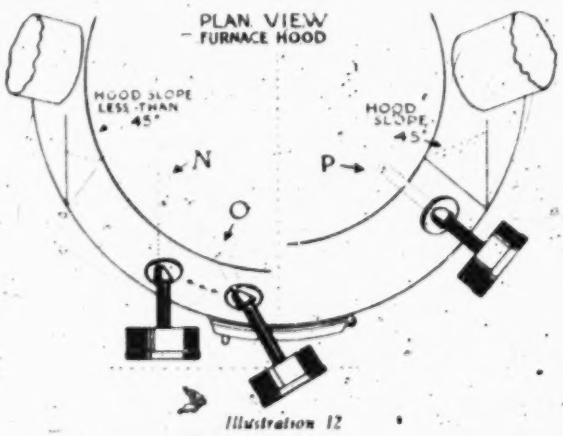



Illustration 12

The instrument is usually placed on the sloped hood of the furnace. If the slope has an angle of 45 degrees the instrument will always be at a radius from the center of the dome.

If the slope is less than 45 degrees from the vertical, more care must be exercised in locating the instrument.

Before attempting to cut a hole, bear in mind two things:

First, it is necessary that the stem, when inserted in the flange, be horizontal in position. Next, see that the face of the instrument is parallel with the front of the furnace. Turn and move the flange until you have accomplished both of these things, then mark the location for the hole which may be cut by a rotary hack saw. The size of the hole should be 1¼". Insert the stem in the flange, and if the instrument is in correct position, as above mentioned, mark the holes for the screws. (See envelope for instructions.)

Illustration 12, "P" shows the control mounted on a 45 degree angle; "O" shows an incorrect mounting, where the angle is less than 45 degrees. It should have been moved to the left as shown in "N".

Before fastening set screws, see that the instrument is plumb or vertical in position. This may be determined by separating the "high" and "low" adjustable pointers, "C" and "D" illustration 9, far enough apart so they will hold the switch kicking plates away from the switch tripping arm "E". The switch must move freely from left to right without interference of the kicking plates. If the switch remains to the right or left after tilting with the finger, the instrument is ready to be fastened by tightening set screw on flange.

Connect wires next. Remove insulating plate indicated as "F" in illustration 11, by removing screw located in center of plate. After wires are connected to terminal posts, one of which is shown in drawing as "G", fasten plate back in position.

Then adjust instrument to the desired operating point.

For fan control the usual setting is about 120 degrees low to 150 degrees high. In case the M-51 is used as a limiting device, the majority of warm air installations are set at approximately 250 to 300 degrees. There are, however, many installations in which this particular adjustment might be insufficient or excessive, therefore a careful study of each case must be made. **Bear in mind that the same results of operation can be obtained by locating the bimetallic element farther away from the dome and adjusting to operate at a lower range.** When setting the cut-in and cut-out points, hold the ratchet wheel firmly with one hand while pressing and moving either the high or low pointer; see illustration 11. When pressing pointers see that the catch between the teeth of the ratchet wheel is disengaged, as shown in "I", illustration 10. When releasing the pressure, be certain that the catch is again engaged, as shown in "J".

At no time should the instrument be subject to more than 650 degrees Fahrenheit.

The instrument leaves the factory with the bimetallic element properly formed, heat-treated, stabilized and calibrated. Should the temperature reading be in error due to someone's twisting the bimetallic element, if not excessively twisted it may be readjusted by allowing the instrument to reach room temperature, loosening the nut in the center of the dial and moving dial until correct reading is obtained, after which the nut should be tightened.

Any manual twisting or bending of the element may permanently distort it. Not only will this destroy the correct calibration of the instrument but also the accurate performance after adjustment is made. It is recommended in case of a badly distorted bimetallic element, that the instrument be either sent back to the factory for re-calibration or a new bimetallic element ordered for replacement. In ordering element for replacement the serial number of the instrument should be supplied.

# THE FREDERICK IRON & STEEL COMPANY

ENGINEERS FOUNDERS AND MANUFACTURERS

FREDERICK, MARYLAND

W. A. RIDDELL, PRESIDENT
J. J. SCHMIDT, VICE PRES. & GEN. MGR.
G. R. HARDIN, VICE PRES. & CHIEF ENGR.
L. A. LEBHERZ, SECRETARY & TREASURER

ALL AGREEMENTS CONTINGENT UPON STRIKES ACCIDENTS OR OTHER CAUSES BEYOND OUR CONTROL.

September 7, 1933.

**Defendant's Exhibit A-A**

The Mercoid Corp.,
4201 Belmont Ave.,
Chicago, Ill.

Gentlemen:

We have on hand six #845 - 38 deg. to 60 deg. Thermostats, and would like to know if these can be changed to 56 deg. to 80 deg. adjustment.

Please send instruction sheet on this model, also on a furnace control Fig. 50 - 250 deg. to 300 deg.

We thank you for this information.

Yours very truly,

THE FREDERICK IRON & STEEL CO.

Albert L. Bier

Stoker Dept.

ALB:MM

September 12, 1933
Dict. 9/11

The Frederick Iron & Steel Co.,
Frederick, Md.,

Attn. - Mr. Albert L. Price, Stoker Dept.

Gentlemen-

We have your favor of September 7th, and would advise, that the cost of changing over the #845 Mercoid Thermostats, range 38 to 80°, to a range 56 to 80°, would be $5.00 to $[illegible].00 each net.

Regarding instructions as to range adjustment on the Figure 50 Mercoid Furnace Control, would advise, the range may be adjusted by simply sliding the stem in or out of the furnace hood, also by the standard adjustment on the back of the case, which is the same as the Figure 31 Control, an instruction sheet on which we are enclosing herewith.

Trusting this will give you the desired information, we remain

Yours very truly,

JWO:DS

VICE PRESIDENT

encl.

November 28
1 9 3 0 .

# Defendant's Exhibit B-B

Mr. H. W. Sweatt, Vice Pres. & Gen. Mgr.,
Minneapolis-Honeywell Regulator Company,
Minneapolis, Minnesota

Dear Harold: Re: Cross Patent

This is the first time I have been at my desk since your letter of November 21 was received.

I have been waiting to hear from both you and Van as to your attitude as regards a license. While waiting for your suggestions, we had our patent attorneys continue their search and as a result of it, I believe that the royalty arrangement that is made with Cross, if any is made, should be on a lower royalty basis than originally suggested.

I will be glad to hear from you.

Very truly yours

JKLathe-cmm

CC - Mr. L. H. Van Ness ✓

July 3, 1931

(Personal)
Mr. Harold E.Sweatt, Vice Pres.,
Minneapolis Honeywell Regulator Co.,
Minneapolis, Minn.

Dear Harold:

Mr. Thorndike, of the American Radiator Company, has told me that there are rumors in the Trade that you people have made a deal in connection with the Cross Stoker Patents. I am sure that these rumors are unfounded, as it is my impression, without referring to our files, that we are pretty thoroughly agreed that neither one of us would take out a license on a royalty basis, under the Cross patent, without conferring with the other.

Will you please drop me a note on this, at your earliest opportunity.

Very truly yours,

LHVN:L

634

ESTABLISHED 1885

# MINNEAPOLIS-HONEYWELL REGULATOR CO.

MINNEAPOLIS, MINN.

July 6, 1931.

Mr. L.H. Van Ness,
The Mercoid Corporation,
4201 Belmont Ave.
Chicago, Ill.

Dear Van:-

I have your letter of July 3rd in reference to the so called Cross stoker patents.

You will recall these circumstances -- Julius negotiating on these Cross patents some time last fall, at which time it was agreed that if we wanted to do anything, the three of us would get together and no-one would do anything until we had conferred with each other.

Since that time nothing further of any kind has been done and I understand that Cross has died during the interval, and we have had no communications with his estate or anyone else. The matter stands, therefore, entirely as it did at the time of our talk last fall, and if you think that it is a good time to take this up at the present time, we might get together and make some sort of an effort to see what we could do with the Cross estate.

My last recollection was that Langdor Moore was going to check into these patents and advise you as to his opinion of their value. We had them checked here at Minneapolis, and the result briefly is about as follows:

We do not feel that the Cross claims covering the periodic starting and stopping of a burner by temperature of the combustion can cover a device located in the stack but that the claims must be limited to the combustion chamber proper. We rather believe that it is going to be difficult to antedate and show prior art on the Cross claims where he controls by the temperature of the water in the boiler.

Yours very truly,

Harold

H.W. Sweatt
JT

ESTABLISHED 1885

# MINNEAPOLIS-HONEYWELL REGULATOR CO.

MINNEAPOLIS, MINN.

Nov. 28, 1932.

Mercoid Corporation,
4201 Belmont Ave.,
Chicago, Ill.

Attention: Mr. L.H. Van Ness.

Gentlemen:-

At a meeting some time ago between Mr. Van Ness, Mr. Reed and myself, it was understood that I was to advise you of certain patents owned or controlled by our company which are being infringed by some of the devices that we understand you are building. Therefore, want to call your attention to these patents and ask that you investigate them and later talk the situation over.

| | |
|---|---|
| Cyr | 1,768,892 |
| Phalen | 1,847,033 |
| Phalen | 1,847,034 |
| Phalen | 1,847,037 |
| | Re.18,361 |
| | 1,847,036 |

All of the above patents in connection with your various types of Pyratherms.

In connection with bonnet mounted furnace controls:

1,736,129
1,782,530
1,847,033
1,847,037.

In connection with stack mounted stoker controls:

1,736,129
1,847,033.

In connection with your ceramic type switches, we believe certain claims of 1,774,108 would be of interest to you, and you are already familiar with the interference proceedings between Cramblet application v. McCabe patent 1,757,436.

In reference to stoker circuits, you are familiar with the fact that we are the sole licensees of the Cross patents and I will not go into detail on them at this time.

636

MINNEAPOLIS-HONEYWELL REGULATOR CO

Mercoid Corporation -2- Nov. 28, 1932.

In reference to your furnace fan circuits, we would call your attention to the Freeman patent No. 1,813,732.

On your type SM Pyratherm, we think you would be interested in studying our patent No. 1,764,344.

In connection with your type SV oil burner control, we very shortly are reissuing our patent No. 1,764,344, which will contain certain new claims which we think will be of interest to you.

In connection with your SM-V Pyratherm, we also want to call your attention to certain of the claims contained in above patent.

In connection with the type 855 room thermostat, certain claims contained in patents Nos. 1,704,370 and 1,736,129, which we believe are infringed.

The same holds true in connection with the #845 room thermostat and the #848 control.

I believe you were going to write me a similar letter after you had studied some of your patents in reference to our devices and will be pleased to have this at your convenience.

Yours very truly,

MINNEAPOLIS-HONEYWELL REGULATOR CO.

H.W. Sweatt

H.W. Sweatt, Vice-Pres. & Gen. Mgr.

HWS:JT

ESTABLISHED 1885

# MINNEAPOLIS-HONEYWELL REGULATOR CO.

MINNEAPOLIS, MINN.

Sept. 30, 1931

L. H. Van Ness, President
Mercoid Corp.
4201 Belmont Ave.
Chicago, Ill.

Dear Van: RE: IRON FIREMAN
CROSS PATENTS

In answer to your letter of September 25th, wish to say that Iron Fireman ran a full page ad in the September issue of the "Midwest Coal Dealer". After reading this ad I am sure you will be able to understand why various stoker manufacturers are very much concerned about the situation.

The patent situation as regards Cross has been changed somewhat because of Iron Fireman's acquisition of the patents mentioned in their ad and because of the broader claims which have been allowed Garrison in his original patent 1,679,418, which has been reissued in the patent number 17,820.

As you probably know, we make some stoker controls wherein the stoker fire is maintained through stack temperature, whereas Iron Fireman's controls are along the principle of an interval timer.

I had a visit with Messrs. Cross at Kansas City last Friday and they promised to write at the end of this week as to whether they would be willing to proceed in entering into a licensing agreement with your Company and our Company along the lines of the verbal understanding which I had with Walter M. Cross, Sr., who died in March of this year. The terms of that understanding was a royalty of 5%, with a minimum of 50¢ per unit.

Your Mr. Moore or McCabe will notice that the Cross patent 1,758,147 covers a different principle than the patent 1,758,146.

MINNEAPOLIS-HONEYWELL REGULATOR CO

L. H. Van Ness -2- 9/30/31

Mr. Cross promised to get from his patent attorney the dates as to the conception and reduction to practice. We here, in view of the Garrison reissue patent, feel that it would be important to have some prior art by which to limit or invalidate the Garrison reissue claims. We would like very much to get any information that Messrs. McCabe or Langdon Moore might have which would have a bearing on this Garrison reissue patent.

I believe you will come to the same conclusion after reading the Iron Fireman ad that we have, namely, that Iron Fireman are aiming directly at the accessory manufacturers as much as at the stoker manufacturers, and we felt that it was very essential to immediately set about to definitely protect ourselves. Would you please give us what thoughts and information you have in regard to the matter?

Yours very truly,

Julius K. Luthe
Vice President

MINNEAPOLIS-HONEYWELL REGULATOR CO.

JKL:CC

1

9/30

**Defendant's Exhibit E-E**

September 25, 1931.

(Personal)
Mr. Julius K. Luthe, V.P.,
Minneapolis-Honeywell Regulator Co.,
Minneapolis, Minn.

Dear Julius:

Subject: Iron Fireman -
Recent ad in trade papers:

Mr. Reed has given me an outline of your talk with him yesterday. Today I have been trying to square up the situation and write you.

As to the Cross patent, I am sure that Mr. Langdon Moore gave us the opinion that this would merely be a donation on our part, if we took out a license, and that the Cross patent, in view of the "prior art," would have no value.

We have heard nothing about this patent for months. Do you have any details as to what patents are cited by Iron Fireman, in the advertisement in question? Have you received any opinion on the subject, from Mr. Maurice Moore?

Also, can you tell me the name of the trade paper in which this ad appeared, and its date of issue?

If, by taking out a license (at a nominal figure) under the Cross patent, we could give assurances to the Trade, that would stimulate their use of controls, and at the same time have the licensor protect us in case of litigation, it would be worth while, if it would result in Net Profit.

Will you please let us have your views, as quickly as possible? As usual, we shall be glad to give consideration to any subject on which we can work to our mutual advantage.

I am sorry that I could not get Langdon Moore's files today and refresh my memory on this subject, which came up some months ago.

With best regards, I remain

Sincerely yours,

LHVK:L

THIS MONTH

DECEMBER

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| 27 | 28 | 29 | 30 | 31 | | |

# MONDAY
# 7
# DECEMBER
1931

NEXT MONTH

JANUARY

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | | | 1 | 2 |
| 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | | | | | | |

give V.N. [illegible]

Monday, December 7

640

Defendant's Exhibit F-F

L to V N

Last time we decided not to join Mpls in this. Langdon Moore & Mc Cabe were at the meeting.

Is there possible trouble if we ignore them now?

Lesh

12/9

ESTABLISHED 1855

THE BROWNELL COMPANY

MANUFACTURERS OF
RIVETED AND WELDED STEEL BOILERS
UNDERFEED STOKERS
MAIN OFFICE AND WORKS
[redacted]

ADDRESS ALL COMMUNICATIONS TO THE COMPANY

CODES
WESTERN UNION
UNIVERSAL FIVE LETTER

**Defendant's Exhibit G-G**

Feb. 26, 1932

Mr. J.W. Owens, V.P.,
Mercoid Corp.,
4201 Belmont Ave.,
Chicago, Ill.

Dear Sir:

We are just in receipt of a letter from the Minneapolis-Honeywell Regulator Company advising that they have purchased the cross patents #1,758,146 and #1,758,147, both dated May 13, 1930.

We presume you are entirely familiar with the coverage of both these patents regarding the use of controls especially in stacks for control of temperature, and as we are using quite a number of your controls for various purposes, we desire to know if we, as purchasers, are fully protected by you from any infringement on above patents. We are using a number of your #848 pressurestats in connection with boiler pressures, your thermostats in connection with air temperature and your #-51 as a stack control. All, of course, in connection with the operating of our stokers.

Will you write us promptly and fully in connection with this matter.

Yours very truly,

THE BROWNELL COMPANY

Chas. E. Wieland
Purchasing Agent

CW:A.

642

ESTABLISHED 1858

# THE BROWNELL COMPANY

MANUFACTURERS OF
RIVETED AND WELDED STEEL BOILERS
UNDERFEED STOKERS
MAIN OFFICE AND WORKS
DAYTON, OHIO

March 3, 1932.

Mercoid Corp.,
4201 Belmont Ave.,
Chicago, Ill.

Gentlemen:

We are in receipt of your letter of Feb. 29 in answer to our letter of Feb. 26 regarding the Cross Patents now owned by the Minneapolis-Honeywell Regulator Company.

We notice copy of your Patent Warranty and while it no doubt covers the situation, nevertheless, if the plain sheet of paper upon which it is written should become detached from your letter in our file, it would be rather difficult to locate same. We would, therefore, kindly ask you to write us again on this matter and embody this Patent Warranty in your letter.

We would again refer to the matter of using your M-51 control in stack and will ask that you advise us if we are fully protected when using this particular control in this manner.

We are enclosing herewith copy of letter received from Minneapolis-Honeywell Regulator Co. under date of Feb. 23 in accordance with your request.

Yours very truly,

THE BROWNELL COMPANY

CEW:MA

Chas. E. Wieland,
Purchasing Agent.

COPY

RE: "CROSS" PATENTS

A very unsatisfactory situation has been brought about in the stoker industry through the growing need of a satisfactory system of preventing the extinguishment of the stoker fire and the fact that the best of such systems were covered by Cross patents No's. 1,758,146 and 1,758,147, both dated May 13, 1930.

Because the uncertainty and risk involved the entire industry, we undertook to negotiate with the owners of the above patents and we are happy to inform you that we have obtained from them an exclusive license under each of the above named patents.

These patents do not cover individual controls as such, but rather, the system or method of preventing the extinguishment of the fire when operating under low heat requirements by means of a system of control which is responsive to either the temperature of the combustion gases or the temperature of the water in the boiler.

Because these patents cover a system involving the controls and the stoker and not the controls alone, we have worked out a special plan whereby a license under these patents can be granted by us to the purchaser. Each of the special stoker controls, namely the "Stokerswitch" and "Holdfire Control", will carry on its nameplate the following legend.

"This Stokerswitch and/or Holdfire Control carries with it a license to use the system of preventing extinguishment of the fire when operating under low heat requirement conditions as covered by patent No. 1,758,146 and or 1,758,147."

This will be notice to the purchaser that, through the inclusion of one of these units, the entire stoker installation is licensed under one of the above named patents. We will be glad to give you any further information in regard hereto which you may wish.

March 15, 1932

The Brownell Company
Dayton, Ohio

Gentlemen:

We will defend any suit or proceeding brought against you so far as based on a claim that any apparatus, or any part thereof, furnished by us, constitutes an infringement of any patent of the United States, provided, that you cause us to be notified promptly in writing and given authority, information and assistance, (at our expense), for the defense of same, and we will pay all damages and costs awarded therein against you in any action of which said notice and authority and information was given to us. In case the apparatus or any part thereof is in such suit held to constitute an infringement and its use is enjoined, we will, at our expense, either: procure for you the right to continue using said apparatus; or replace same with non-infringing apparatus; or modify it so it becomes non-infringing; or remove said apparatus and refund the purchase price and the transportation and installation costs thereof. The foregoing states our entire liability for patent infringement by said apparatus or any part thereof.

Yours very truly,

THE MERCOID CORPORATION

LBR:GH

Vice-President

ESTABLISHED 1855

THE BROWNELL COMPANY

MANUFACTURERS OF
RIVETED AND WELDED STEEL BOILERS
UNDERFEED STOKERS

ADDRESS ALL COMMUNICATIONS TO THE COMPANY

MAIN OFFICE AND WORKS

CODES
WESTERN UNION
UNIVERSAL FIVE LETTER

Oct. 7, 1930

Enoid Corp.,
4201 Belmont Ave.,
Chicago, Ill.

Gentlemen:

We are in receipt of letter from the Mid-Continent Investment Co., Kansas City, Mo., copy attached which is self-explanatory.

Sometime ago we had up with you the matter of your protection to us when referring to infringement on controls such as you manufacture. We are not quite sure whether the enclosed refers to the cross patents or some other patents and we would be pleased to have report from you as to whether we are protected in this particular instance as it so happens we use your I-SI control in stack control work on stoker installations.

Yours very truly,

THE BROWNELL COMPANY

Chas. [illegible]ield,
Purchasing Agent.

COPY

Sept. 28, 1932

Kansas City, Mo.

Brownell Co.,
Dayton, Ohio.

Gentlemen:

Your attention is called by this letter to patents No. 1,758,146 and 1,758,147 owned by this company. The first of these patents covers a dual control in stoker operation providing for automatically regulating the fuel feeding means and, at the same time, automatically maintaining the fuel bed to prevent extinguishment of the fire.

Any method of using automatic control instruments for preventing extinguishment of fire, if such control is "actuated by a pre-determined minimum temperature for said combustion space for preventing extinguishment of the fire when operating under low heat requirement conditions," would come within the scope of this patent.

The sale of a stoker together with such an instrument or the sale of the instrument alone for use in the dual control of the stoker operation constitutes infringement of these patents. We therefore suggest that in the purchase of your control instruments you ascertain if you are also purchasing rights under the above named patents, so that you will be fully protected in this matter.

Very truly yours,

MID-CONTINENT INVESTMENT COMPANY

Forbes Cross.

TELEPHONE
MAIN 1328

MID-CONTINENT INVESTMENT COMPANY
700 BALTIMORE AVENUE
KANSAS CITY, MISSOURI

September 28, 1932

Brownell Company
Dayton
Ohio

Gentlemen:

Your attention is called by this letter to patents No. 1,758,146 and 1,758,147 owned by this company. The first of these patents covers a dual control in stoker operation providing for automatically regulating the fuel feeding means and, at the same time, automatically maintaining the fuel bed to prevent extinguishment of the fire.

Any method of using automatic control instruments for preventing extinguishment of fire, if such control is "actuated by a pre-determined minimum temperature for said combustion space for preventing extinguishment of the fire when operating under low heat requirement conditions," would come within the scope of this patent.

The sale of a stoker together with such an instrument or the sale of the instrument alone for use in the dual control of the stoker operation constitutes infringement of these patents. We therefore suggest that in the purchase of your control instruments you ascertain if you are also purchasing rights under the above named patents, so that you will be fully protected in this matter.

Very truly yours,

MID-CONTINENT INVESTMENT COMPANY

By Forbes Crane

FFC.RS

CABLE ADDRESS "WILL-BURT"

# THE WILL-BURT COMPANY

MANUFACTURERS

DESIGNERS MACHINISTS

ORRVILLE, OHIO February 29, 1932.

SUBJECT Cross Patents.

**Defendant's Exhibit H-H**

ATTENTION Mr. L. H. VanNess,
President.

Mercoid Corporation,
4201 Belmont Ave.,
Chicago, Illinois.

Gentlemen:-

We are enclosing you copy of letter received under date of February 25th from the Minneapolis-Honeywell Regulator Company.

According to this letter, they seem to feel that they control the situation covering the low temperature stack control.

We wish you would give us some further information regarding it and your recommendations to us as to whether you think we ought to buy the stack controls from the Minneapolis-Honeywell people for the time being, or do you feel that these patents can be proven invalid as suggested in your letter of June 4, 1931.

We will appreciate anything that you have to offer on the subject.

Yours very truly,

B. G. Cope, Pres.

BGC:CMD
enc

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

MINNEAPOLIS, MINNESOTA.

February 25, 1932.

Mr. B. G. Cope,
Will-Burt Company,
Orrville, Ohio.

Dear Mr. Cope: RE: "CROSS" PATENTS

A very unsatisfactory situation has been brought about in the stoker industry through the growing need of a satisfactory system of preventing the extinguishment of the stoker fire and the fact that the best of such systems were covered by Cross patents Nos. 1,758,146 and 1,758,147, both dated May 13, 1930.

Because the uncertainty and risk involved the entire industry, we undertook to negotiate with the owners of the above patents and we are happy to inform you that we have obtained from them an exclusive license under each of the above named patents.

These patents do not cover individual controls as such, but rather, the system or method of preventing the extinguishment of the fire when operating under low heat requirements by means of a system of control which is responsive to either the temperature of the combustion gases or the temperature of the water in the boiler.

Because these patents cover a system involving the controls and the stoker and not the controls alone, we have worked out a special plan whereby a license under these patents can be granted by us to the purchaser. Each of the special stoker controls, namely the "Stokerswitch" and "Holdfire Control", will carry on its nameplate the following legend.

"This Stokerswitch and/or Holdfire Control carries with it a license to use the system of preventing extinguishment of the fire when operating under low heat requirement conditions as covered by patent No. 1,758,146 and/or 1,758,147."

This will be notice to the purchaser that, through the inclusion of one of these units, the entire stoker installation is licensed under one of the above named patents. We will be glad to give you any further information in regard hereto which you may wish.

Very truly yours,

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

C. B. Sweatt
Vice President.

CBS:CC

c o p y

650

6/29

June 4th, 1931

The Will-Burt Company,
Orrville, Ohio.

**Defendant's Exhibit H-H-1**

Attention - Mr. B. O. Cope, Pres.

Dear Sir:

Subject: MERCOID CONTROLS

We do appreciate very deeply, indeed, the personal interest in our product, as indicated in your letter of June 1st. We have been doing business with your company over a long period of years, and our relations have been highly satisfactory and pleasant from all standpoints.

Without question, the stoker industry represents a potential market of the largest proportions, and we are convinced it is going to be developed on a sound basis. What you have to say about your air control that will accompany your stoker is of the utmost interest to us, and, if you feel disposed, and have covered your design by patent application, please let us have a circular describing it.

As to the controls listed by you, namely --

| | | |
|---|---|---|
| 1 - | #8585 Mercoid Thermostat - | $24.00 list |
| 2 - | M-51 Furnace Controls - - | 18.00 ea. list |
| 1 - | Fig. 36 Immersion Type Control | 21.00 list. |
| 1 - | #848 C-1 or H-1 Controls - | 32.00 " |
| 1 - | #848 Model C Control - - | 38.00 " |

we beg to quote you 50-10-10% on these controls in assorted lots of 25 or more, ordered forward in one shipment -- and on smaller lots 50-10%.

These prices cover standard ranges. Where special ranges are involved, the discount is 50%.

All quotations are based on shipment F.O.B. factory.

We are hoping to be able to offer you a much cheaper control for vapor jobs, although we are inclined to believe they represent a comparatively small per-

centage of the installation you will be concerned with, at least for the present.

As to patent matters, we are just about as much"at sea"as you are. We employ a patent counsel by the year and he spends an average of two days a week with us. We look upon our patents and patent claims largely as building up a defense rather than expecting to bring action against infringers. We have to depend upon our product and policies to bring in the business, primarily. There are many people who are trying to secure patents on a device, or combination of applications, hoping to live on the royalty -- such hopes,as you no doubt well know, are realized very infrequently.

We sell our Mercoid product to wide fields of application -- in fact all the way from peanut-vending machines and chicken-dusting machines to power plants and hydraulic presses. We really cannot accept responsibility for an opinion on a patent such as the Gray & Murdock to which you refer. These people wrote us some months ago and, after consulting our patent counsel, we told them that we could not see how any of our controls infringed patents of theirs. To the best of my knowledge, we have not heard from them since that time. Our patent counsel has told us that he gravely questions whether the Gray & Murdock patents would be sustained in view of their doubtful validity, so that their claims should be narrowly construed. We do not feel that we can go further in this patent situation than to say that we guarantee each instrument we sell against any infringement that might be brought as to our Mercoid instruments per se. How they are hooked up and used covers such a large field of application that we would have to employ a staff of patent counsels to make validity searches, etc. if we were to attempt to embrace and cover, from a patent standpoint, our product. Any special inquiries and opinions you desire to receive through us from our patent counsel will be forthcoming. A validity search, however, involves such a considerable expense that we don't feel justified in undertaking it for the many types of applications for which we manufacture.

We are writing you with the utmost frankness, and want to give you complete co-operation in every way possible.

Yours very truly,

LHVN:H

PRESIDENT.

652

Defendant's Exhibit I-I

# COMBUSTIONEER · · INC·

AUTOMATIC·COAL·BURNERS

GOSHEN · INDIANA · U·S·A·

ADDRESS ALL COMMUNICATIONS TO COLUMBIA ST. AND BECHTLE AVE.
SPRINGFIELD, OHIO

June 14, 1932.

The Mercoid Corporation
4201 Belmont Avenue
Chicago Illinois.

Attention Mr. H. A. Matthews.
Sales Engineer.

Dear Sir:

I wish to inform you at this time that after careful studying of the controls for our stokers, we have decided to use the Mercoid controls, particularly for low voltage. As a matter of fact, in certain information mailed our dealers, we have specified the Mercoid Controls on our domestic stokers, and in addition have also specified the Penn Electric. We have proposals giving the dealer a choice of ordering with their stokers either the Penn Electric or the Mercoid.

As you naturally surmise, the Penn Electric low voltage controls have been quoted to us at a lower price than the Mercoid. Now I am frank to state that we very much prefer the Mercoid controls, and particularly on account of what you have now to offer us in the low voltage type, and we are not hesitating to advise our dealers to order the Mercoid in preference to the Penn. We have been testing your Relay and Sensatherm for some time and find this thermostat to be very sensitive, and so far neither the thermostat or relay has caused us any trouble whatsoever although there is hum in the relay. This hum may be characteristic of this particular relay I have under test, and not in your entire line. I raise the question.

We are anxious to place an order for at least 25 of the units in a combination of the Sensatherm and Relay, besides a limit control and also a hold fire control. According to your quotations on this, which I have, this combination would amount to $20.50. Before placing this order, we natually would like to enter into contract with you such as is customary, strictly on a consignment basis.

Will you kindly favor us immediately with your form of contract along this line.

A few months ago we received a communicati fr m the Minneapolis Honeywell Company i forming us of their patent rights covering the Hold fire controls. They you no doubt know were certain claims as established by the Cross Ptents. Their letter to us was simply i forming us of these patent rights, and cautioning us against the use of controls that might infringe. Following that, we have aksed protection from infringement suits whereever we are purchasing equipment, and I am su e that you will agree with us that this is highly proper and necessary. To that end, please find attached a form of guarantee against such suits or liability on our part. We would be very pleased to have you include such a guarantee either on the form which we are se ding you or a form of your own, equivalent in nature for our protection.

We wish to tha k you for the courtesies in regard to assisting us in selecting and standardizing on the Mercoid Controls.

Yours very truly

COMBUSTIONEER INC

J. H. Walter
Chief Engineer.

J. H. Walter.
MH

I-I-1

# Defendant's Exhibit I-I-1

GUARANTEE AGAINST INFRINGEMENT SUITS.

In consideration of the purchase of (specify Equipment purchased) (Selling Company) of (State and City) agrees that it will indemnify and keep harmless Combustioneer, Inc., the purchaser, against any and all liabilities, proceedings, judgements and cost which may accure or be recovered from against said purchaser in consequence of the infringement or alleged infringement by said purchaser of any letters patent of the United States by reason of the use or sale of said (above mentioned equipment) and that it will defray all expenses incurred in the carrying on, to final disposition, of the defense of any such suit or action for such infringement, provided that if such infringement action or suit be brought or threatened said purchaser will promptly notify (selling Company) of such threat, action or suit.

IN WITNESS WHEREOF (selling company) has caused this guarantee to be executed by an officer of said corporation, for that purpose duly qualified, this _____ day of _____ 1932.

(Selling Company)

By _____
Aforesaid Officer.

PHONE West 1230

The BARDES STOKER WORKS

2619 COLERAIN AVENUE

CINCINNATI, OHIO

Defendant's Exhibit J-J

October 7th, 1933

Mercoid Corporation
4201 Belmont Avenue
Chicago Illinois

Gentlemen -

We have received a letter from Mid-Continent Investment Company calling our attention to patents 1,758,146 and 1,758,147. We have received from Minneapolis-Honeywell Regulator Company and Penn Electric Switch Company the early part of this year, letters stating we were protected.

Have you any word for us along this line and must we buy from Minneapolis-Honeywell or Penn Electric Switch Company rather than you?

Yours ~~faithfully~~,

Vice Pres.

**PARAGON KOL-MASTER CORPORATION**

AUTOMATIC COAL BURNERS
DOMESTIC, COMMERCIAL, INDUSTRIAL
GENERAL OFFICES AND FACTORY
OREGON, ILLINOIS

**Defendant's Exhibit K-K**

October 12, 1933

The Mercoid Corporation,
4201 Belmont Avenue,
Chicago, Illinois.

Attention: Mr. Owens.

Gentlemen:

Will you advise us whether we will have your protection against any patent infringements in the use of your stack control?

We have been advised that users of controls coming under the Cross patent are to be sued for infringement.

Before we can purchase further stack controls from your Company, we would like to have your advice on this subject.

Very truly yours,
PARAGON KOL-MASTER CORPORATION

Jas. F. Lee

JFH:FEG

President.

LEPHONE
MAIN 1328

MID-CONTINENT INVESTMENT COMPANY
700 BALTIMORE AVENUE
KANSAS CITY, MISSOURI

**Defendant's Exhibit L-L**

November 21, 1932

The Mercoid Corporation
4201 Belmont Ave.
Chicago, Ill.

Att: Mr. Lewis B. Reed
Vice President

Gentlemen:

Please pardon our belated reply to your letter of November 8.

Regarding the infringement notices to the Brownell Company of Dayton, Ohio, and to the Will Burt Company of Orville, Ohio, we wish to advise that the sale or use of any automatic stoker control that is actuated by the predetermined temperature of the combustion space for preventing extinguishment of fires in operating low heat requirement conditions, no matter where the control is placed, is an infringement of United States patents 1,758,146 and 1,758,147.

We have obtained a copy of your circular showing automatic controls for stokers and forced draft feed coal equipment. On Page 7 of this bulletin appears your Type N-16 Stoker Control, the sale and use of which infringes the two above patents.

We trust that you will immediately take all necessary steps to obtain protection under these patents, in order that you and your customers may be relieved of any liability in this matter.

Very truly yours,

MID-CONTINENT INVESTMENT COMPANY

By Forbes Cross

MFC.RS

658

# Fairbanks, Morse & Co.

400 SOUTH WABASH AVENUE

CHICAGO

June 5, 1934

**Defendant's Exhibit M-M**

11/1 - 36

Mercoid Corporation
4201 Belmont Avenue
Chicago, Illinois

Attention: Mr. J. W. Owens

Gentlemen:

Attached is a copy of a letter recently received from the Mid-Continent Investment Company. It is self-explanatory. We wish to have a commitment from your company regarding this matter, together with satisfactory evidence of protection against any possible action or annoyance from possible patent litigation.

Very truly yours,

FAIRBANKS, MORSE & CO.

B M Guthrie

Chief Engineer,
STOKER DIVISION.

BMGuthrie:AP

C O P Y

MID-CONTINENT INVESTMENT COMPANY
700 Baltimore Avenue
Kansas City, Missouri

June 2, 1934

Fairbanks, Morse & Company, Stoker Division
900 South Wabash
Chicago, Illinois

Gentlemen:

It has recently been called to our attention that you are purchasing controls for the purpose of maintaining pre-determined minimum fire-box temperature in connection with stoker fired furnaces from a Company not licensed by us to sell controls for this purpose.

We wish to make this a formal notification to you that we consider the sale and use of controls for this purpose an infringement of Cross Patent number 1758146.

Very truly yours,

MID-CONTINENT INVESTMENT CO.

WMC:RL

BY: Walter M. Cross, Jr.

660

ESTABLISHED 1855

# THE BROWNELL COMPANY

MANUFACTURERS OF
RIVETED AND WELDED STEEL BOILERS
UNDERFEED STOKERS
MAIN OFFICE AND WORKS
DAYTON, OHIO

Dec. 18, 1934

Mercoid Corp.,
4201 Belmont Ave.,
Chicago, Ill.

Defendant's Exhibit N-N

12-21

ALL CONTRACTS OR BUSINESS OF ANY NATURE BINDING THE BROWNELL COMPANY MUST BE MADE SUBJECT TO THE APPROVAL AND ACCEPTANCE OF THE BROWNELL COMPANY AT THEIR HOME OFFICE DAYTON, OHIO ALL AGREEMENTS CONTINGENT UPON FIRES, STRIKES, ACCIDENTS OR OTHER CAUSES BEYOND OUR CONTROL

Gentlemen:

We are in receipt of a letter from our representative at Valparaiso, Nebraska in which he states that Mr. Forrest L. Raikes, Ashland, Nebr. wrote you regarding an M-51 control which apparently gave some trouble. We understand from your letter that you wrote this party recommending your M-61 control and would be pleased to know just what your recommendations to him cover.

If your Mr. Owens will recall we have beenusing for several years your M-51 as a stack control. If your M-61 has any advantages over M-51, we would be pleased to know about it.

Yours very truly,

THE BROWNELL COMPANY

CEW:MA

Chas. E. Wieland,
Purchasing Agent.

December 21, 1934

The Brownell Company
Dayton, Ohio

Attn: Mr. Chas. E. Wieland,
Purchasing Agent

Gentlemen:

With reference to your letter of the 18th, regret to advise that we are unable to locate any record of our correspondence with Mr. Forrest L. Maikes as mentioned in the first paragraph of your letter.

With reference to the second paragraph of your letter, would advise that the writer was given to understand that you were using the M-51 as a Stoker Switch, and inasmuch as there was a slight saving to you in the purchase price of this control over the M-61, the matter was not gone into very thoroughly at the time of our discussion.

However, the difference between the two controls is that the M-61 is built with a different size sleeve more suitable for stack mounting. Furthermore, the design of the M-61 permits of the use of the stainless steel well, which, of course, is essential for protection of the bi-metal element. Please see bulletin #240 enclosed herewith.

We trust that this will give you the desired information, and remain,

Very truly yours,

VICE-PRESIDENT

JWO:C
Enc. #240

Defendant's Exhibit OO

DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS
WASHINGTON

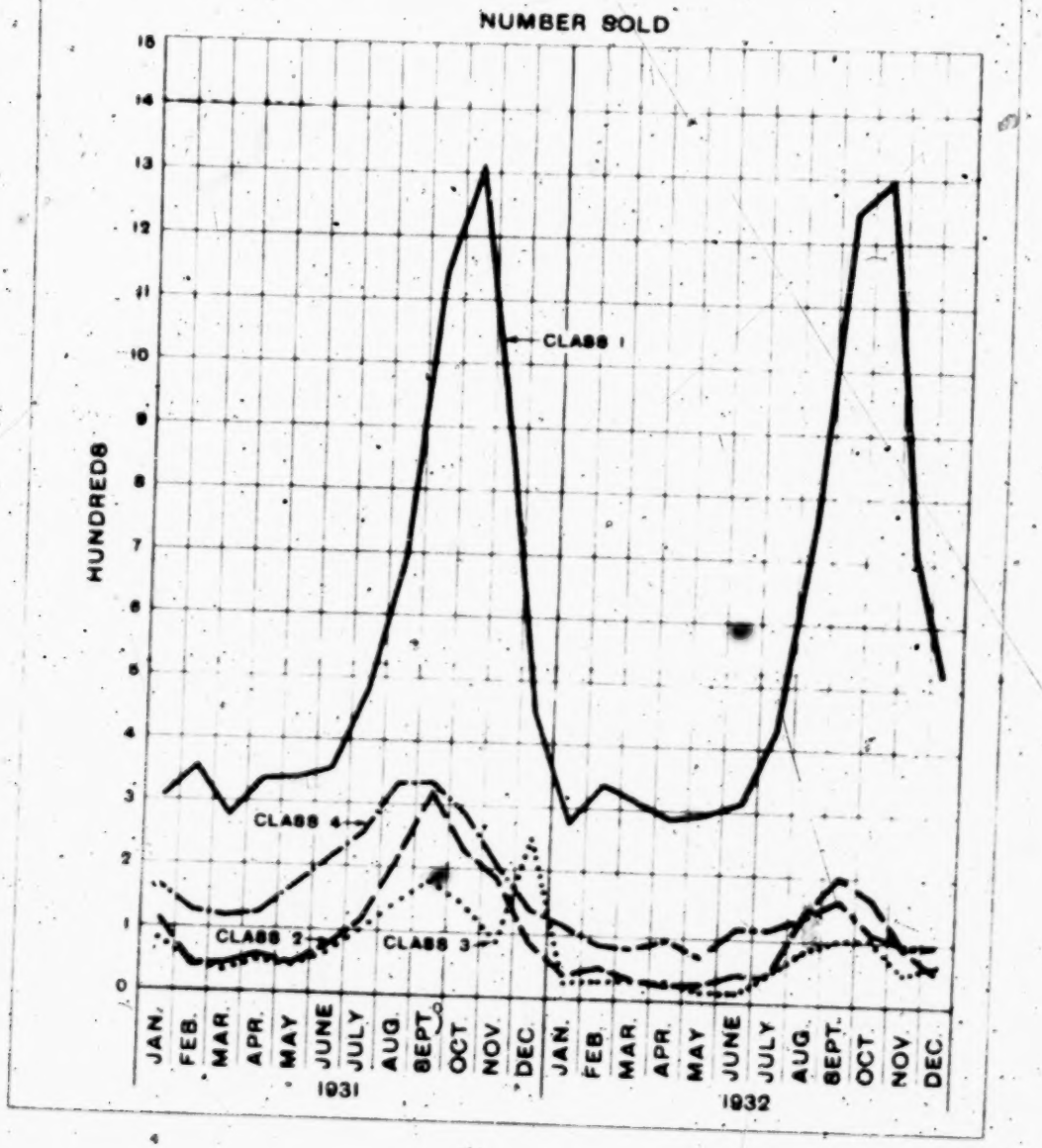
FOR RELEASE ON
FEBRUARY 7, 1933

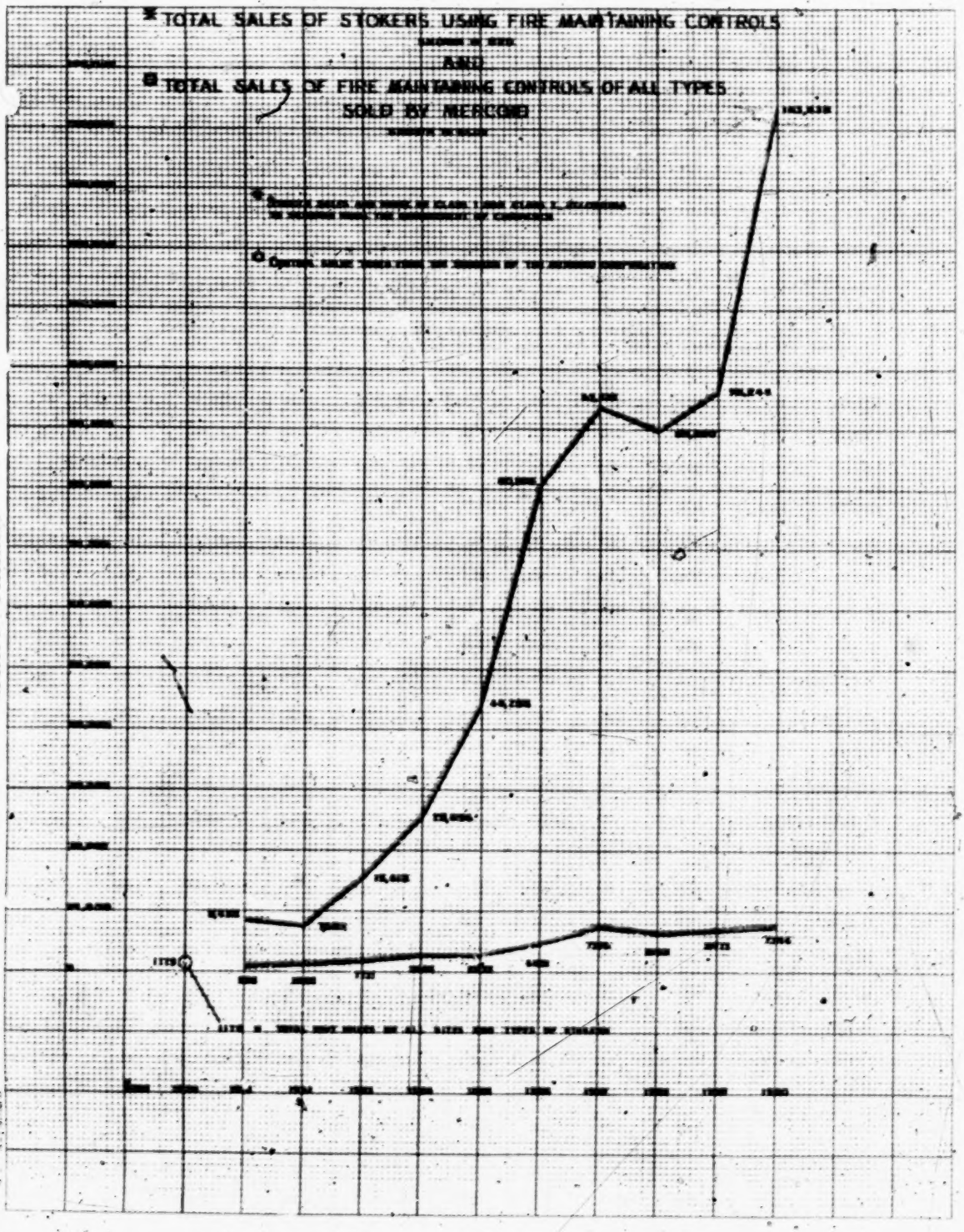
**Defendant's Exhibit O-O**

# MECHANICAL STOKERS

DECEMBER, 1932

COMPARED WITH PRECEDING MONTHS




TOTAL SALES OF STOKERS USING FIRE MAINTAINING CONTROLS
AND
TOTAL SALES OF FIRE MAINTAINING CONTROLS OF ALL TYPES
SOLD BY MERCOID

December, 1932

Compared with preceding months

664

Statistics on sales of mechanical stokers, based on data reported to the Bureau of the Census by 56 identical manufacturers, are presented in the table below. Of the 56 establishments reporting, 36 manufacture Class 1 stokers, 30 manufacture Class 2, 27 manufacture Class 3, and 42 manufacture Class 4.

NOTE: A mechanical stoker is a device consisting of a mechanically-operated feeding mechanism and a grate and is used for the purpose of feeding solid fuel into a furnace, admitting air to the fuel for the purpose of combustion and providing a means for removal or discharge of refuse. Hand stokers are not included.

Mechanical stokers for which statistics are given below are classified, by use, as follows:

Class 1. - Residential (capacity less than 100 pounds of coal per hour).
Class 2. - Apartment house and small commercial heating jobs (capacity 100 to 800 pounds of coal per hour).
Class 3. - General commercial heating and small high pressure steam plants (capacity 800 to 300 pounds of coal per hour).
Class 4. - Large commercial and high pressure steam plants (capacity over 300 pounds of coal per hour).

| Year and Month | Class 1 | Class 2 | Class 3 | CLASS - 4 | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | TOTAL | | INSTALLED UNDER - | | | |
| | | | | | | Fire-tube boilers | | Water-tube boilers | |
| | NUMBER | | | Number | Horsepower | Number | Horsepower | Number | Horsepower |
| 1931 | | | | | | | | | |
| January | 305 | 116 | 81 | 164 | 36,319 | 112 | 15,186 | 52 | 20,133 |
| February | 353 | 42 | 48 | 126 | 20,686 | 88 | 10,768 | 38 | 10,173 |
| March | 377 | 43 | 33 | 118 | 24,352 | 79 | 10,298 | 39 | 14,054 |
| April | 335 | 38 | 30 | 124 | 25,820 | 86 | 11,914 | 38 | 13,906 |
| May | 338 | 47 | 44 | 127 | 34,870 | 113 | 14,779 | 54 | 19,891 |
| June | 333 | 76 | 45 | 212 | 42,175 | 149 | 19,456 | 63 | 22,720 |
| July | 478 | 117 | 101 | 288 | 39,308 | 208 | 25,765 | 81 | 13,627 |
| August | 698 | 209 | 143 | 333 | 54,878 | 241 | 32,773 | 72 | 22,105 |
| September | 1,142 | 318 | 178 | 336 | 55,698 | 279 | 40,570 | 57 | 15,522 |
| October | 1,307 | 228 | 144 | 288 | 50,023 | 231 | 30,698 | 54 | 19,328 |
| November | 666 | 183 | 89 | 206 | 28,071 | 170 | 23,340 | 36 | 8,731 |
| December | 427 | 88 | 246 | 139 | 24,288 | 119 | 17,034 | 28 | 7,319 |
| Total (Year) | 6,815 | 1,880 | 1,833 | 2,488 | 440,078 | 1,899 | 288,871 | 574 | 187,507 |
| 1932 | | | | | | | | | |
| January | 275 | 37 | 32 | 118 | 34,248 | 70 | 10,308 | 48 | 23,936 |
| February | 338 | 49 | 29 | 80 | 18,779 | 63 | 8,209 | 28 | 8,568 |
| March | 313 | 35 | 30 | 83 | 25,084 | 60 | 8,629 | 23 | 16,437 |
| April | 296 | 43 | 29 | 98 | 14,909 | 80 | 9,828 | 18 | 5,081 |
| May | 293 | 36 | 18 | 69 | 13,688 | 41 | 5,240 | 28 | 7,449 |
| June | 318 | 43 | 14 | 113 | 23,098 | 68 | 8,751 | 48 | 14,348 |
| July | 438 | 44 | 46 | 114 | 25,068 | 70 | 8,605 | 44 | 16,463 |
| August | 789 | 148 | 88 | 137 | 26,056 | 99 | 13,219 | 38 | 12,827 |
| September | 1,248 | 300 | 100 | 186 | 29,139 | 119 | 14,430 | 67 | 14,709 |
| October | 1,899 | 167 | 188 | 117 | 20,819 | 96 | 13,240 | 21 | 7,579 |
| November | 709 | 89 | 50 | 91 | 13,288 | 79 | 10,108 | 18 | 3,178 |
| December | 821 | 58 | 64 | 96 | 18,378 | 78 | 11,774 | 20 | 6,604 |
| Total (Year) | 6,755 | 916 | 888 | 1,297 | 281,819 | 880 | 122,344 | 367 | 159,173 |

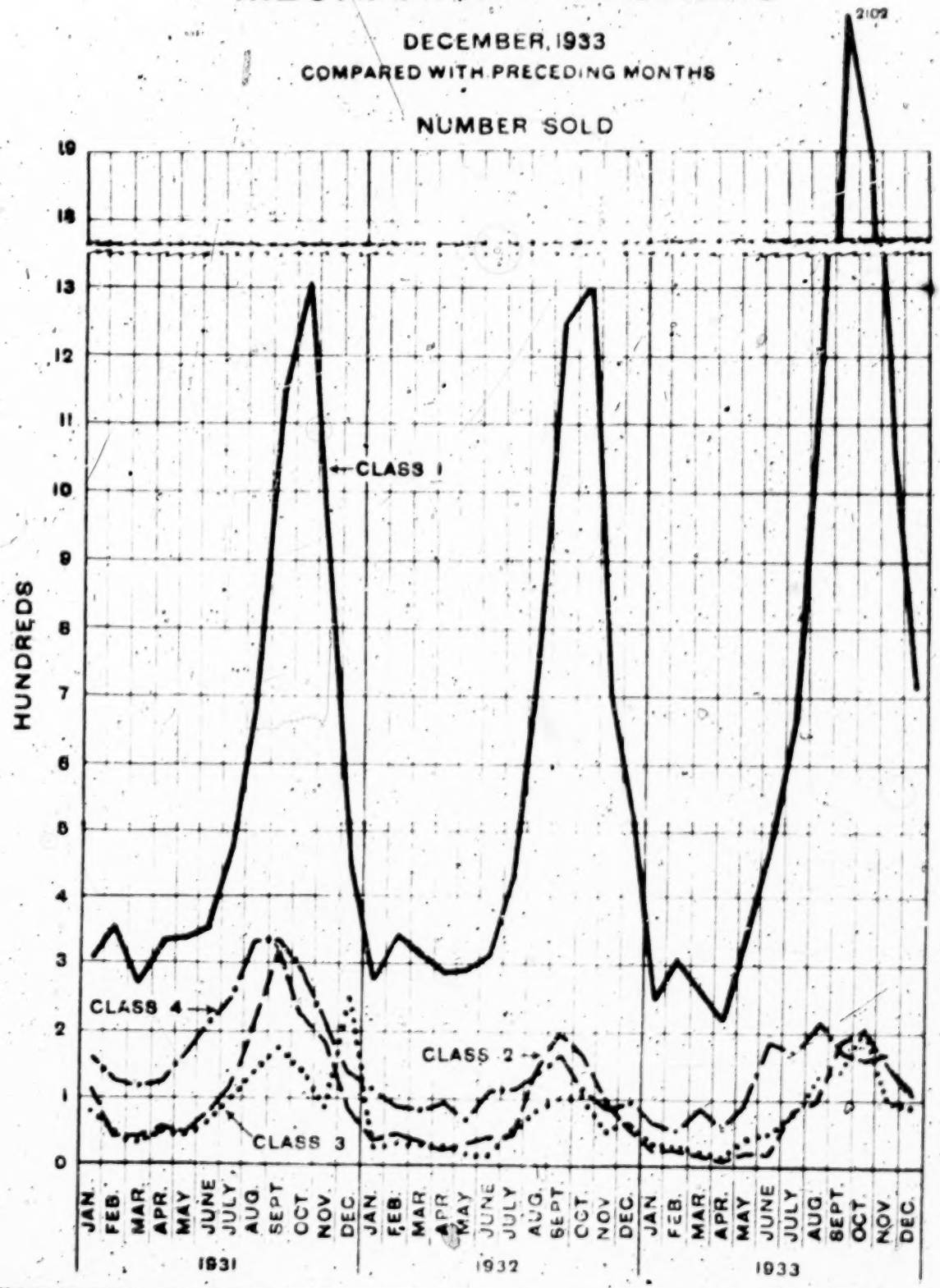
FOR RELEASE ON RECEIPT

DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS
WASHINGTON

665

# MECHANICAL STOKERS

DECEMBER, 1933
COMPARED WITH PRECEDING MONTHS



666

December, 1933.

Compared with preceding months

Statistics on sales of mechanical stokers, based on data reported to the Bureau of the Census by 82 identical manufacturers, are presented in the table below. Of the 86 establishments reporting, 29 manufacture Class 1 stokers, 30 manufacture Class 2, 27 manufacture Class 3, and 48 manufacture Class 4.

Mechanical stokers for which statistics are given below are classified, by use, as follows:

Class 1. - Residential (capacity less than 100 pounds of coal per hour).
Class 2. - Apartment house and small commercial heating jobs (capacity 100 to 200 pounds of coal per hour).
Class 3. - General commercial heating and small high pressure steam plants (capacity 200 to 300 pounds of coal per hour).
Class 4. - Large commercial and high pressure steam plants (capacity over 300 pounds of coal per hour).

A mechanical stoker is a device consisting of a mechanically-operated feeding mechanism and a grate and is used for the purpose of feeding solid fuel into a furnace, distributing it on the fuel bed for the purpose of combustion and providing a means for removal or discharge of refuse. Hand stokers are not included.

| Year and Month | Class 1 | Class 2 | Class 3 | CLASS - 4 | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | TOTAL | | INSTALLED DURING | | | |
| | | | | | | Fire-tube boilers | | Water-tube boilers | |
| | NUMBER | | | Number | Horsepower | Number | Horsepower | Number | Horsepower |
| 1931 | | | | | | | | | |
| January | 305 | 116 | 81 | 184 | 36,818 | 112 | 15,180 | 86 | 20,133 |
| February | 353 | 42 | 68 | 126 | 20,935 | 88 | 10,782 | 38 | 10,173 |
| March | 277 | 43 | 35 | 118 | 24,352 | 79 | 10,280 | 39 | 14,084 |
| April | 335 | 58 | 30 | 124 | 25,880 | 88 | 11,914 | 36 | 13,906 |
| May | 358 | 47 | 44 | 167 | 34,870 | 113 | 14,779 | 54 | 19,891 |
| June | 353 | 98 | 66 | 212 | 42,178 | 149 | 18,488 | 63 | 23,720 |
| July | 478 | 119 | 101 | 226 | 39,392 | 202 | 25,768 | 81 | 13,627 |
| August | 696 | 206 | 143 | 353 | 54,878 | 281 | 32,773 | 72 | 22,103 |
| September | 1,142 | 318 | 178 | 334 | 56,892 | 279 | 40,870 | 57 | 15,322 |
| October | 1,307 | 286 | 144 | 288 | 50,025 | 221 | 30,693 | 54 | 19,332 |
| November | 868 | 183 | 86 | 206 | 38,071 | 170 | 23,340 | 36 | 8,731 |
| December | 449 | 86 | 848 | 139 | 24,888 | 119 | 17,084 | 22 | 7,819 |
| Total (Year) | 6,915 | 1,580 | 1,225 | 2,643 | 440,079 | 1,899 | 252,971 | 594 | 187,807 |
| 1932 | | | | | | | | | |
| January | 298 | 37 | 23 | 113 | 34,842 | 70 | 10,206 | 43 | 23,884 |
| February | 256 | 49 | 29 | 89 | 18,777 | 63 | 8,209 | 26 | 8,568 |
| March | 313 | 33 | 30 | 85 | 29,066 | 60 | 8,829 | 25 | 18,437 |
| April | 288 | 23 | 29 | 98 | 14,909 | 80 | 9,888 | 18 | 5,081 |
| May | 293 | 35 | 19 | 88 | 18,689 | 41 | 8,260 | 28 | 9,469 |
| June | 312 | 43 | 14 | 113 | 22,094 | 68 | 8,781 | 48 | 13,313 |
| July | 432 | 84 | 46 | 114 | 22,888 | 70 | 8,626 | 44 | 14,262 |
| August | 759 | 143 | 82 | 139 | 26,084 | 89 | 13,798 | 50 | 12,287 |
| September | 1,248 | 200 | 100 | 166 | 29,139 | 119 | 14,430 | 47 | 14,709 |
| October | 1,299 | 189 | 102 | 119 | 20,819 | 96 | 13,240 | 21 | 7,579 |
| November | 709 | 89 | 50 | 91 | 13,888 | 79 | 10,108 | 12 | 3,178 |
| December | 881 | 55 | 64 | 98 | 18,378 | 98 | 11,774 | 80 | 6,601 |
| Total (Year) | 6,783 | 916 | 585 | 1,297 | 321,819 | 980 | 122,346 | 347 | 139,173 |
| 1933 | | | | | | | | | |
| January | 251 | 24 | 33 | 43 | 12,348 | 30 | 7,488 | 13 | 4,780 |
| February | *309 | *28 | *31 | *50 | *11,438 | *37 | *4,982 | 13 | *6,486 |
| March | 252 | 18 | 22 | 04 | 10,830 | 67 | 8,794 | 17 | 7,756 |
| April | *220 | * 9 | * 15 | 37 | 13,289 | 88 | 3,370 | 31 | 10,229 |
| May | 337 | 19 | 42 | 95 | 23,212 | 52 | 7,488 | 41 | 15,719 |
| June | *490 | 18 | 49 | 187 | 32,723 | 137 | 16,838 | 50 | 15,800 |
| July | 666 | 65 | 81 | *190 | 41,249 | 105 | 14,337 | *65 | 26,912 |
| August | 1,199 | 98 | 134 | 213 | 40,644 | 183 | 17,877 | 80 | 22,767 |
| September | 2,102 | 186 | 142 | *178 | *39,042 | *148 | *18,804 | *28 | *20,818 |
| October | *1,896 | *288 | *209 | *162 | *33,684 | *133 | *16,482 | 29 | 9,033 |
| November | 1,048 | *180 | 101 | 166 | 32,891 | 128 | 14,888 | 40 | 18,208 |
| December | 718 | 118 | 90 | 113 | 17,997 | 100 | 13,743 | 13 | 4,280 |
| Total (Year) | 10,807 | 968 | 951 | 1,845 | 294,087 | 1,128 | 144,089 | 479 | 149,988 |

*Revised

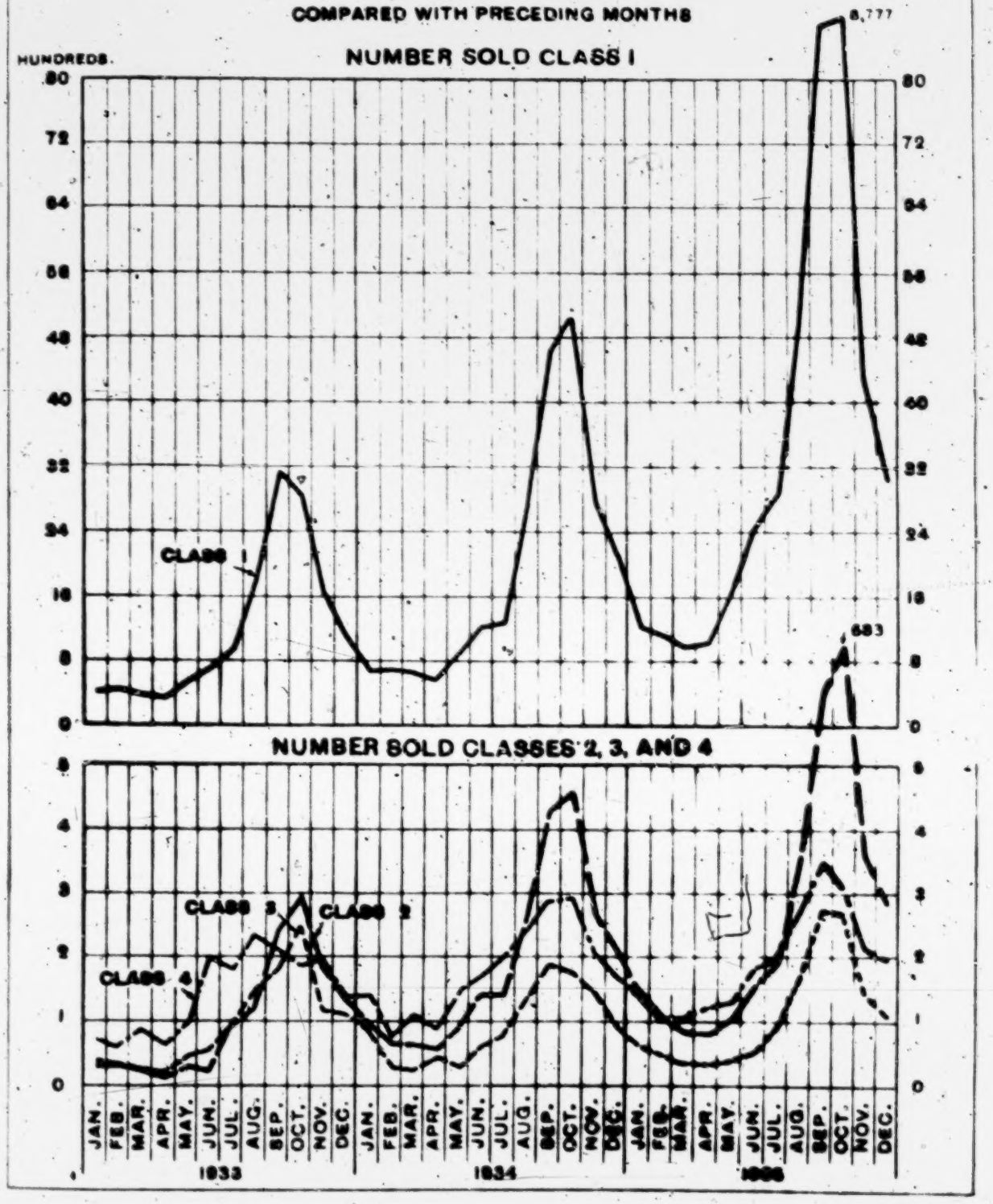
FOR RELEASE ON RECEIPT

DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS
WASHINGTON

# MECHANICAL STOKERS

DECEMBER, 1935

COMPARED WITH PRECEDING MONTHS



FOR RELEASE
RECEIPT

DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS
WASHINGTON



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MECHANICAL STOKERS

December, 1936

Compared with preceding months

Statistics on sales of mechanical stokers, based on data reported by 108 identical manufacturers, were released today by Director William L. Austin, Bureau of the Census, Department of Commerce, and are presented in the following table. Class 1 stokers were reported for December by 97 manufacturers; Class 2, by 34; Class 3, by 23; and Class 4, by 36. The manufacturers, whose data are included in these statistics, produced approximately 9; per cent of the total value of the output in the industry at the Census of Manufactures for 1935.

These statistics represent a new series. Data for the months of 1932 in previous releases were reported by 32 manufacturers.

Mechanical stokers for which statistics are given below are classified, by use, as follows:

Class 1. - Residential (capacity less than 100 pounds of coal per hour).
Class 2. - Apartment house and small commercial heating jobs (capacity 100 to 300 pounds of coal per hour).
Class 3. - General commercial heating and small high pressure steam plants (capacity 300 to 500 pounds of coal per hour).
Class 4. - Large commercial and high pressure steam plants (capacity over 300 pounds of coal per hour).

[A mechanical stoker is a device consisting of a mechanically-operated feeding mechanism and a grate and is used for the purpose of feeding solid fuel into a furnace, admitting air to the fuel for the purpose of combustion and providing a means for removal or discharge of refuse. Hand stokers are not included.]

| Year and Month | Class 1 | Class 2 | Class 3 | TOTAL | | CLASS - 4 INSTALLED UNITS | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Fire-tube boilers | | Water-tube boilers | |
| | UNITS | | | Number | Horsepower | Number | Horsepower | Number | Horsepower |
| 1935 | | | | | | | | | |
| January | 1,841 | 147 | 61 | 129 | 84,339 | 105 | 13,873 | 25 | 11,084 |
| February | 1,113 | 109 | 68 | 106 | 81,184 | 68 | 6,719 | 39 | 18,449 |
| March | 904 | 84 | 37 | *108 | *83,886 | 69 | 7,789 | *39 | *18,807 |
| April | 1,048 | 83 | 33 | 120 | 28,841 | 77 | 13,652 | 43 | 18,589 |
| May | 1,906 | 109 | 41 | *135 | 38,348 | 88 | 12,643 | *45 | 19,805 |
| June | 2,432 | 158 | 56 | *178 | 34,821 | 129 | 28,534 | *49 | 18,287 |
| July | 2,892 | 190 | 96 | 196 | 43,594 | 151 | 20,020 | 48 | 23,574 |
| August | 4,931 | 348 | 154 | 868 | 47,356 | 183 | 24,298 | 78 | 23,057 |
| September | 5,589 | 618 | 272 | 345 | 55,280 | 275 | 33,148 | 70 | 22,132 |
| October | 6,777 | 843 | 288 | 310 | 51,051 | 275 | 36,071 | 35 | 14,980 |
| November | 4,267 | 359 | 145 | 215 | 34,849 | 170 | 21,483 | 45 | 13,366 |
| December | 3,575 | 881 | 108 | 196 | 34,166 | 159 | 18,379 | 37 | [illegible] |
| Total, Year | 41,128 | 3,163 | 1,548 | 2,310 | 434,854 | 1,704 | 285,927 | 556 | 809,027 |
| 1936 | | | | | | | | | |
| January | 660 | 90 | 89 | 140 | 20,681 | 117 | 13,496 | 23 | 8,625 |
| February | 856 | 65 | 30 | 99 | 19,159 | 52 | 7,750 | 25 | 11,4[illegible] |
| March | 944 | 84 | 22 | 109 | 26,289 | 65 | 9,350 | 44 | 16,909 |
| April | 560 | 58 | 41 | 90 | 25,879 | 50 | 8,385 | 40 | 17,494 |
| May | 902 | 86 | 88 | 150 | 30,858 | 115 | 19,008 | 35 | 11,850 |
| June | 1,815 | 140 | 60 | 178 | 34,879 | 130 | 15,561 | 48 | 19,318 |
| July | 1,870 | 141 | 98 | 200 | 44,100 | 131 | 17,968 | 69 | 26,[illegible]74 |
| August | 2,678 | 269 | 133 | 241 | 45,893 | 191 | 20,002 | 50 | 18,8[illegible] |
| September | 4,836 | 429 | 188 | 289 | 41,987 | 248 | 28,527 | 38 | 13,46[illegible] |
| October | 5,[illegible]79 | 458 | 199 | 288 | 48,625 | 248 | 27,382 | 44 | 19,243 |
| November | 4,781 | 288 | 142 | 215 | 39,767 | 160 | 22,166 | 25 | 17,621 |
| December | 4,125 | 210 | 90 | 167 | 29,199 | 139 | 17,394 | 30 | 10,[illegible]05 |
| Total, Year | 25,714 | 2,382 | 1,278 | 2,130 | 400,145 | 1,854 | 209,840 | 478 | 193,[illegible]05 |
| 1937 | | | | | | | | | |
| January | 1,412 | 90 | 56 | 71 | 15,088 | 59 | 8,279 | 13 | 6,79[illegible] |
| February | 445 | 30 | 32 | 61 | 11,712 | 38 | 5,152 | 23 | 6,781 |
| March | 556 | 22 | 25 | 67 | 17,010 | 70 | 8,854 | 17 | 7,756 |
| April | 330 | 11 | 18 | 62 | 14,659 | 39 | 5,5[illegible] | 34 | 11,[illegible]96 |
| May | 550 | 39 | 45 | 09 | 23,997 | 51 | 7,845 | 44 | 16,152 |
| June | 718 | 81 | 52 | 199 | 34,105 | 144 | 17,900 | 50 | 16,[illegible]0[illegible] |
| July | 954 | 91 | 91 | 179 | 43,384 | 112 | 15,[illegible]32 | 67 | 27,[illegible]62 |
| August | 1,990 | 120 | 147 | 231 | 43,484 | 166 | 19,60[illegible] | 65 | 23,819 |
| September | 3,110 | 241 | 181 | 211 | 33,[illegible]15 | 183 | 22,[illegible]97 | 28 | 10,[illegible]18 |
| October | 2,940 | 256 | 248 | 168 | 27,8[illegible]4 | 151 | 18,[illegible]41 | 31 | [illegible],143 |
| November | 1,037 | 184 | 117 | 104 | 39,[illegible]18 | 154 | 14,911 | 60 | 24,[illegible]5 |
| December | 1,060 | 138 | 110 | 157 | 20,042 | 124 | 11,819 | 33 | 8,[illegible]23 |
| Total, Year | 14,212 | 1,806 | 1,098 | 1,919 | 313,613 | 1,594 | 181,144 | 435 | 132,[illegible]68 |

* Revised.
2-26-37

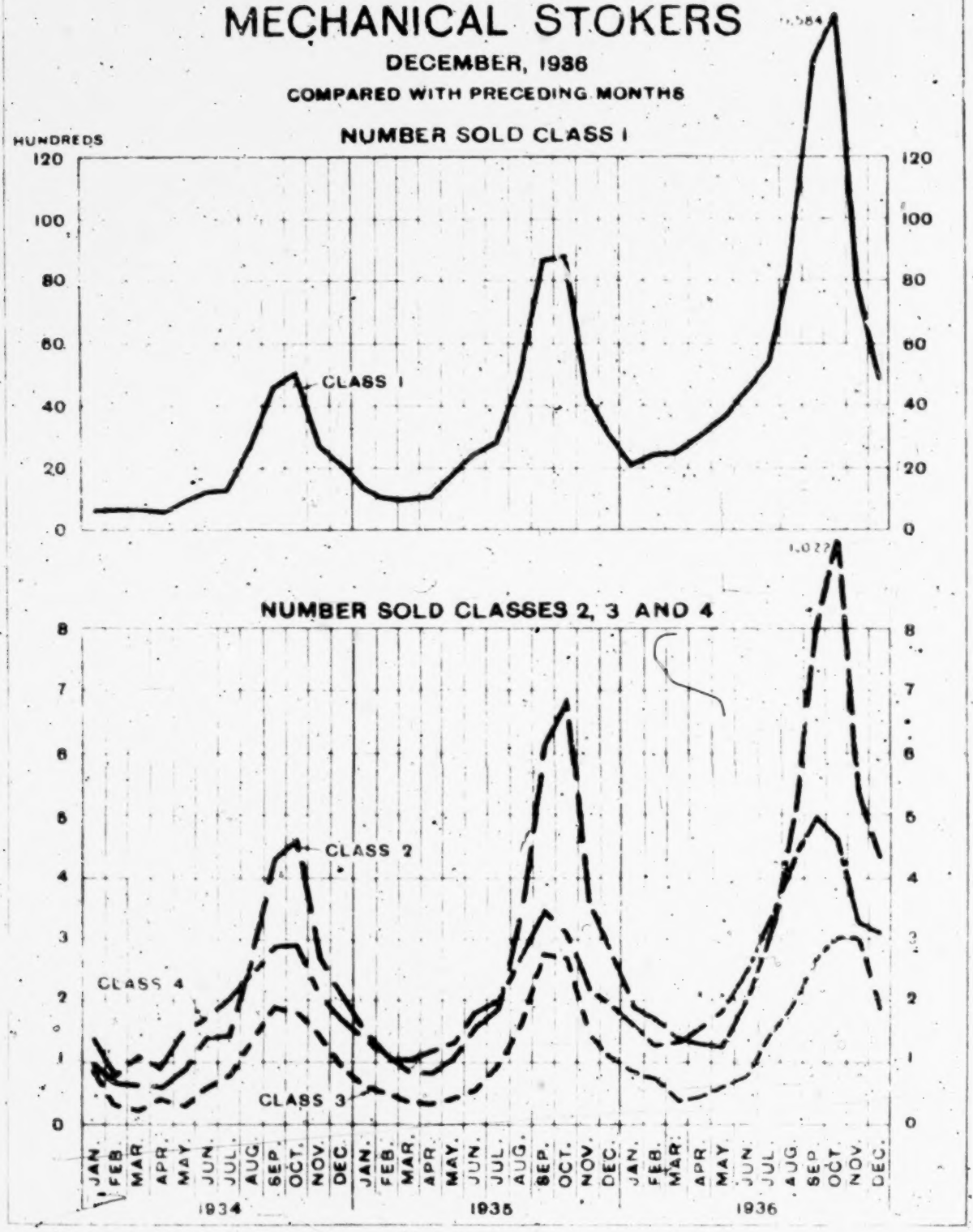
FOR IMMEDIATE RELEASE

DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS
WASHINGTON

# MECHANICAL STOKERS

**DECEMBER, 1936**

**COMPARED WITH PRECEDING MONTHS**



FOR RELEASE
RELEASE

DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS
WASHINGTON



MECHANICAL STOKERS

December, 1936

Compared with preceding months

Statistics on sales of mechanical stokers, based on data reported by 107 identical manufacturers, were released today by Director William L. Austin, Bureau of the Census, Department of Commerce. Class 1 stokers were reported for December by 88 manufacturers; Class 2, by 58; Class 3, by 50; and Class 4, by 61. Sales of stokers as reported for the month of December, 1936, amounted to 5,822 as compared with 9,041 for November, 1936; 3,863 for December, 1935, and 8,588 for December, 1934. The manufacturers whose data are included in these statistics produced approximately 91 per cent of the total value of the output in the industry at the census of manufactures for 1935.

Mechanical stokers for which statistics are given below are classified by use, as follows:

Class 1. - Residential (capacity less than 100 pounds of coal per hour).
Class 2. - Apartment house and small commercial heating jobs (capacity 100 to 300 pounds of coal per hour).
Class 3. - General commercial heating and small high pressure steam plants (capacity 300 to 500 pounds of coal per hour).
Class 4. - Large commercial and high pressure steam plants (capacity over 300 pounds of coal per hour).

[A mechanical stoker is a device consisting of a mechanically-operated feeding mechanism and a grate and is used for the purpose of feeding solid fuel into a furnace, admitting air to the fuel for the purpose of combustion and providing a means for removal or discharge of refuse. Hand stokers are not included.]

| Year and month | Class 1 | Class 2 | Class 3 | TOTAL | | CLASS 4 INSTALLED UNDER | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Fire-tube boilers | | Water-tube boilers | |
| | NUMBER | | | Number | Horsepower | Number | Horsepower | Number | Horsepower |
| 1936 | | | | | | | | | |
| January* | 2,114 | 188 | 84 | 182 | 7,697 | 34 | 16,640 | 4 | 10,857 |
| February* | 2,442 | 197 | 71 | 80 | 8,884 | 28 | 13,987 | 30 | 11,882 |
| March* | 2,493 | 138 | 41 | 253 | 24,805 | 108 | 14,835 | 29 | 10,250 |
| April* | 2,478 | 136 | 44 | 68 | 17,550 | 99 | 13,444 | 34 | 30,898 |
| May* | 2,387 | 124 | 44 | 134 | 26,859 | 130 | 21,328 | 38 | 19,742 |
| June* | 4,432 | 208 | 79 | 84 | 24,917 | 164 | 23,174 | 38 | 27,346 |
| July | 8,648 | 318 | 148 | 334 | 27,218 | 230 | 30,815 | 81 | 31,603 |
| August | 8,433 | 492 | 196 | 634 | 80,386 | 854 | 41,860 | 99 | 34,348 |
| September | 10,082 | 648 | 270 | 449 | 75,108 | 437 | 30,890 | 82 | 24,618 |
| October | 14,574 | 1,082 | 303 | 668 | 89,130 | 401 | 62,767 | 81 | 26,367 |
| November | 9,869 | 589 | 301 | 324 | 42,890 | 273 | 44,880 | 51 | 14,430 |
| December | 6,897 | 631 | 180 | 349 | 79,836 | 245 | 43,827 | 84 | 30,998 |
| Total (Year) | 81,374 | 4,548 | 1,758 | 3,575 | 665,00 | 2,734 | 384,195 | 648 | 276,897 |
| 1935 | | | | | | | | | |
| January | 1,841 | 147 | 81 | 116 | 4,776 | 100 | 12,875 | 36 | 11,044 |
| February | 1,113 | 107 | 46 | 100 | 21,134 | 60 | 8,717 | 39 | 12,447 |
| March | 956 | 84 | 39 | 105 | 24,[illegible] | 68 | 7,739 | 37 | 10,897 |
| April | 1,046 | 85 | 33 | 126 | 31,241 | 97 | 13,652 | 43 | 18,389 |
| May | 1,706 | 107 | 41 | 133 | 32,548 | 80 | 12,845 | 42 | 19,900 |
| June | 2,452 | 158 | 56 | 196 | 54,871 | 175 | 18,534 | 49 | 18,357 |
| July | 2,472 | 190 | 93 | 199 | 42,544 | 151 | 21,050 | 48 | 23,494 |
| August | 4,081 | 348 | 194 | 269 | 64,370 | 193 | 24,739 | 76 | 25,057 |
| September | 6,897 | 615 | 272 | 41 | 7,260 | 295 | 32,146 | 70 | 22,118 |
| October | 8,779 | 863 | 368 | 310 | 51,021 | 275 | 34,471 | 30 | 14,980 |
| November | 6,897 | 359 | 145 | 212 | 34,849 | 194 | 21,463 | 43 | 13,386 |
| December | 3,979 | 381 | 108 | 146 | 34,186 | 159 | 19,979 | 37 | 13,797 |
| Total (Year) | 41,[illegible]76 | 3,182 | 1,347 | 2,[illegible]10 | 454,974 | 1,754 | 230,377 | 554 | 209,089 |
| 1934 | | | | | | | | | |
| January | 660 | 98 | 98 | 14[illegible] | 2[illegible]80 | 119 | 11,485 | 33 | 8,435 |
| February | 894 | 65 | 50 | 99 | 14,149 | 58 | 7,750 | 25 | 11,407 |
| March | 644 | 54 | 22 | 109 | 24,899 | 65 | 9,530 | 44 | 18,856 |
| April | 765 | 54 | 41 | 90 | 25,478 | 50 | 6,085 | 40 | 17,584 |
| May | 938 | 40 | - | 1[illegible] | 2[illegible]93 | [illegible] | 7,308 | 35 | 11,860 |
| June | 1,815 | 140 | 80 | 172 | 34,[illegible]14 | 124 | 14,541 | 52 | 19,318 |
| July | 1,[illegible]70 | 142 | 78 | 203 | 44,[illegible]10 | 151 | 17,988 | 88 | 26,134 |
| August | 2,[illegible]76 | 189 | 152 | [illegible] | 47,[illegible]90 | 191 | 25,008 | 50 | 18,891 |
| September | 4,836 | 470 | 19[illegible] | [illegible]47 | 41,[illegible]97 | 248 | 28,527 | 54 | 13,468 |
| October | 5,[illegible]77 | 678 | [illegible] | 262 | 44,423 | 248 | 27,[illegible]68 | 44 | 19,041 |
| November | 3,751 | 245 | 142 | 22[illegible] | 33,[illegible]60 | 180 | 22,146 | 85 | 17,851 |
| December | 2,[illegible]25 | 210 | 90 | 187 | 34,[illegible]99 | 139 | 17,304 | 50 | 18,855 |
| Total (Year) | 33,814 | 2,892 | 1,098 | 2,[illegible]30 | 430,145 | 1,904 | 206,660 | 678 | 188,888 |

* Revised.

FOR IMMEDIATE RELEASE

DEPARTMENT OF COMMERCE

BUREAU OF THE CENSUS

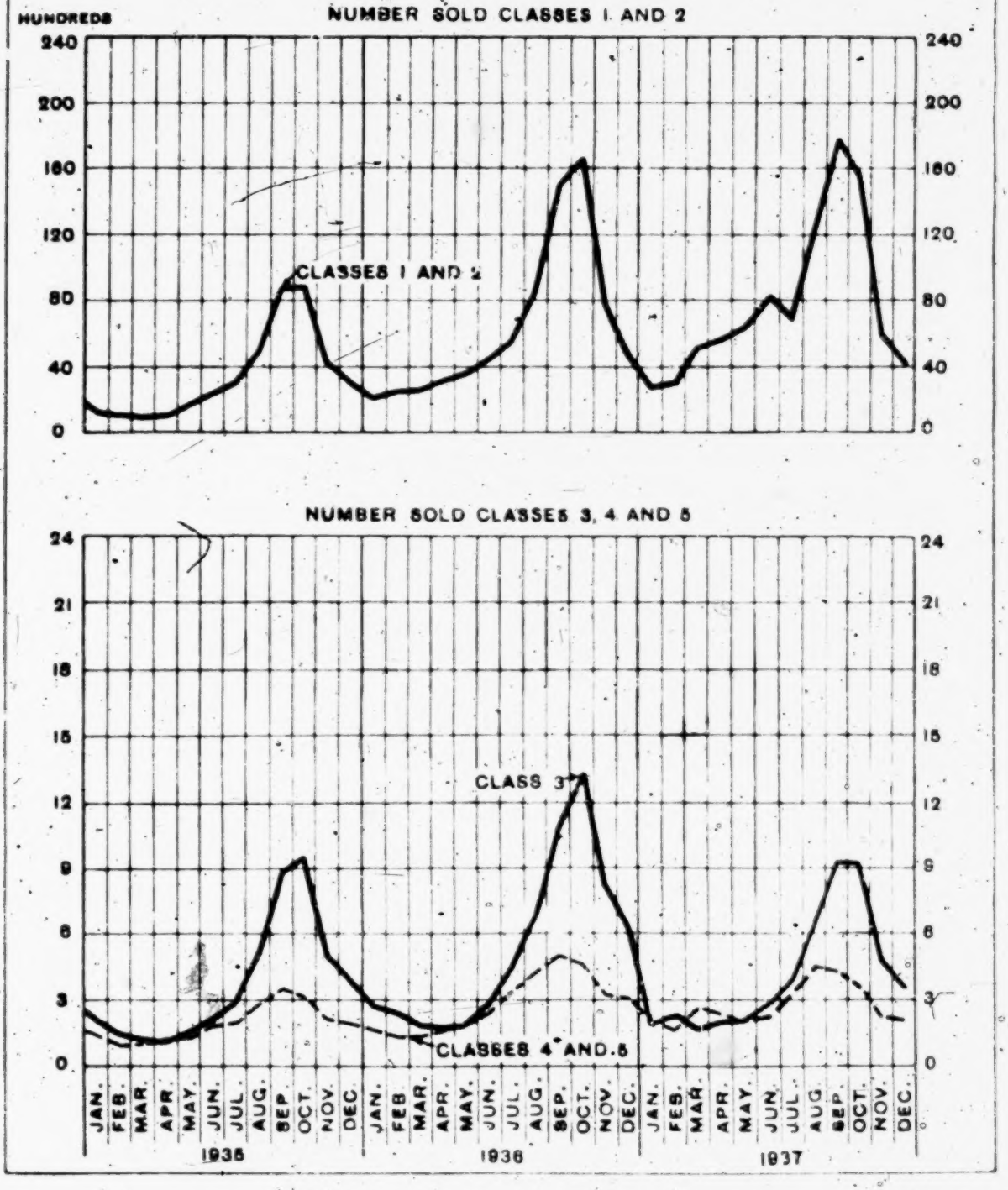
WASHINGTON

FACTORY SALES OF

# MECHANICAL STOKERS

DECEMBER 1937

COMPARED WITH PRECEDING MONTHS



FOR IMMEDIATE RELEASE

DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS
WASHINGTON

Factory Sales of
MECHANICAL STOKERS

December 1937

Compared with preceding months

Statistics on factory sales of mechanical stokers, based on data reported by 108 identical manufacturers, were released today by Director William L. Austin, Bureau of the Census, Department of Commerce. Class 1 stokers were reported for December by 61 manufacturers; Class 2, by 39; Class 3, by 49; Class 4, by 28; and Class 5, by 11. Sales of stokers reported for the month of November 1937 amounted to 4,650 as compared with 4,[illegible] for December 1937, 5,[illegible] for December 1936, and 3,[illegible] for December 1935. The manufacturers whose data are included in these statistics produced approximately 90 per cent of the total value of the output of the industry as reported at the Census of Manufactures for 1935.

Mechanical stokers on the schedule form used in 1937 are classified, by use, as follows:

Class 1 for residential use (bituminous and anthracite).
Class 2 for small apartment house, flat, and small commercial heating jobs.
Class 3 for apartment house, and general small commercial heating jobs.
Class 4 for large commercial and small high pressure steam plants (small industrial).
Class 5 for high pressure steam plants (industrial).

[A mechanical stoker is a device consisting of a mechanically-operated feeding mechanism and a grate and is used for the purpose of feeding solid fuel into a furnace, admitting air to the fuel for the purpose of combustion and providing a means for removal or discharge of refuse. Hand stokers are not included.]

Table 1.---STATISTICS FOR DECEMBER 1937, WITH COMPARATIVE DATA FOR NOVEMBER, 1937, AND DECEMBER 1936 AND 1935, AND TOTALS FOR THE YEARS 1937, 1936, AND 1935

| Item | 1937 | | 1936 | 1935 | Total (Year) | | |
|---|---|---|---|---|---|---|---|
| | December | November | December | December | 1937 | 1936 | 1935 |
| Class 1 (Capacity under 4 pounds of coal per hour) | | | | | | | |
| Total number of stokers | 3,870 | 3,[illegible] | | | 87,[illegible] | | |
| Total boiler horsepower | 3,[illegible] | 4,[illegible] | | | 98,[illegible] | | |
| Total sales | [illegible] | 789 | 4,[illegible] | 3,[illegible] | 9,[illegible] | 78,[illegible] | 44,[illegible] |
| Class 2 (Capacity 41 to 300 pounds of coal per hour) | | | | | | | |
| Number of stokers | 581 | 514 | | | 8,[illegible] | | |
| Class 3 (Capacity 301 to 800 pounds of coal per hour) | | | | | | | |
| Total number of stokers | [illegible] | [illegible] | [illegible] | [illegible] | 5,[illegible] | [illegible] | [illegible] |
| Total boiler horsepower | 18,[illegible] | 19,[illegible] | | | [illegible] | | |
| Installed under fire-tube boilers | | | | | | | |
| Number of stokers | 348 | [illegible] | | | 4,[illegible] | | |
| Boiler horsepower | 15,118 | 19,[illegible] | (1) | (1) | 216,[illegible] | (1) | (1) |
| Installed under water-tube boilers | | | | | | | |
| Number of stokers | 8 | --- | | | 38 | | |
| Boiler horsepower | 280 | --- | | | 1,[illegible] | | |
| Class 4 (Capacity 801 to 1,800 pounds of coal per hour) 2/ | | | | | | | |
| Total number of stokers | 187 | [illegible] | [illegible] | 138 | 2,[illegible] | 2,[illegible] | 2,[illegible] |
| Total boiler horsepower | 21,[illegible] | 19,[illegible] | 75,[illegible] | 54,166 | 310,[illegible] | [illegible] | [illegible] |
| Installed under fire-tube boilers | | | | | | | |
| Number of stokers | 144 | 174 | [illegible] | 129 | 2,[illegible] | 2,[illegible] | 1,[illegible] |
| Boiler horsepower | 21,138 | 18,[illegible] | 43,[illegible] | 18,[illegible] | [illegible] | [illegible] | [illegible] |
| Installed under water-tube boilers | | | | | | | |
| Number of stokers | 8 | 7 | [illegible] | 37 | 97 | [illegible] | [illegible] |
| Boiler horsepower | [illegible] | 1,[illegible] | [illegible] | 18,[illegible] | 18,[illegible] | [illegible] | [illegible] |
| Class 5 (Capacity 1,801 pounds of coal per hour and over) | | | | | | | |
| Total number of stokers | 60 | 60 | | | 827 | | |
| Total boiler horsepower | 13,[illegible] | 14,[illegible] | | | 313,[illegible] | | |
| Installed under fire-tube boilers | | | | | | | |
| Number of stokers | 21 | 18 | (2) | (2) | [illegible] | (2) | (2) |
| Boiler horsepower | [illegible] | 3,[illegible] | | | 67,[illegible] | | |
| Installed under water-tube boilers | | | | | | | |
| Number of stokers | 19 | 34 | | | 541 | | |
| Boiler horsepower | [illegible] | 11,[illegible] | | | 245,[illegible] | | |

1/ Not called for on schedules.
2/ Class 4, as used in 1936 and 1935, comprised stokers with capacity of over 300 pounds of coal per hour, and data for these years are practically equivalent to data for present Classes 4 and 5 combined.

[illegible]

DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS
WASHINGTON



Factory Sales of
MECHANICAL STOKERS - Continued

Table 2.---DETAILED STATISTICS, BY MONTHS, 1937

| Year and Month | Class 1 Number* Total | Class 1 Number* Bituminous | Class 1 Number* Anthracite | Class 2 Number | CLASS 3 Total Number | CLASS 3 Total Horsepower | CLASS 3 Installed under Fire-tube boilers Number | CLASS 3 Installed under Fire-tube boilers Horsepower | CLASS 3 Installed under Water-tube boilers Number | CLASS 3 Installed under Water-tube boilers Horsepower |
|---|---|---|---|---|---|---|---|---|---|---|
| 1937 | | | | | | | | | | |
| January | 2,604 | 2,313 | 291 | 198 | 185 | 7,836 | 177 | 7,506 | 8 | 330 |
| February | 2,833 | 2,566 | 316 | 199 | 228 | 11,271 | 226 | 11,191 | 2 | 80 |
| March | 4,312 | 4,128 | 484 | 236 | 167 | 7,515 | 166 | 7,475 | 1 | 40 |
| April | 3,847 | 4,089 | 458 | 307 | 203 | 8,938 | 203 | 8,938 | - | - |
| May | 6,096 | 5,624 | 472 | 279 | 208 | 9,272 | 204 | 9,252 | 1 | 40 |
| June | 7,813 | 7,199 | 614 | 280 | 289 | 13,508 | 286 | 13,388 | 3 | 120 |
| July | 8,682 | 8,976 | 478 | 408 | 382 | 17,919 | 378 | 17,759 | 4 | 160 |
| August | 11,890 | 10,988 | 1,806 | 760 | 457 | 29,540 | 455 | 29,460 | 2 | 80 |
| September | 16,088 | 14,854 | 1,734 | 1,288 | 953 | 39,054 | 929 | 38,916 | 4 | 138 |
| October | 14,682 | 12,916 | 1,866 | 1,181 | 880 | 38,254 | 815 | 38,089 | 5 | 165 |
| November | 8,222 | 4,256 | 787 | 814 | 473 | 19,818 | 473 | 19,218 | - | - |
| December | 8,870 | 8,089 | 641 | 381 | 381 | 15,896 | 343 | 15,116 | 6 | 780 |
| Total (Year) | 97,681 | 90,897 | 9,074 | 6,088 | 5,005 | 218,897 | 4,904 | 216,907 | 39 | 1,989 |

| Year and Month | CLASS 4 Total Number | CLASS 4 Total Horsepower | CLASS 4 Installed under Fire-tube boilers Number | CLASS 4 Installed under Fire-tube boilers Horsepower | CLASS 4 Installed under Water-tube boilers Number | CLASS 4 Installed under Water-tube boilers Horsepower | CLASS 5 TOTAL Number | CLASS 5 TOTAL Horsepower | CLASS 5 Installed under Fire-tube boilers Number | CLASS 5 Installed under Fire-tube boilers Horsepower | CLASS 5 Installed under Water-tube boilers Number | CLASS 5 Installed under Water-tube boilers Horsepower |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1937 | | | | | | | | | | | | |
| January | 148 | 22,818 | 124 | 17,870 | 18 | 4,948 | 61 | 24,304 | 16 | 3,764 | 45 | 20,540 |
| February | 119 | 20,648 | 110 | 18,258 | 9 | 2,388 | 48 | 16,585 | 10 | 2,388 | 34 | 14,198 |
| March | 159 | 20,313 | 147 | 18,700 | 12 | 1,613 | 100 | 42,670 | 32 | 6,009 | 68 | 36,661 |
| April | 132 | 16,884 | 131 | 16,436 | 1 | 80 | 84 | 43,564 | 23 | 6,439 | 71 | 37,125 |
| May | 134 | 17,386 | 118 | 16,251 | 6 | 1,078 | 78 | 30,644 | 19 | 5,192 | 59 | 25,252 |
| June | 165 | 20,208 | 161 | 20,044 | 4 | 164 | 70 | 28,809 | 25 | 6,568 | 45 | 19,241 |
| July | 220 | 34,884 | 220 | 30,784 | 12 | 3,048 | 80 | 30,634 | 15 | 3,440 | 67 | 27,194 |
| August | 348 | 44,488 | 328 | 43,560 | 7 | 928 | 87 | 30,689 | 36 | 8,584 | 51 | 21,968 |
| September | 349 | 41,189 | 341 | 40,179 | 8 | 1,010 | 86 | 17,066 | 28 | 6,715 | 38 | 10,349 |
| October | 287 | 38,189 | 279 | 38,089 | 8 | 1,108 | 76 | 34,608 | 31 | 7,980 | 45 | 26,628 |
| November | 181 | 19,684 | 174 | 18,448 | 7 | 1,011 | 60 | 14,240 | 16 | 3,080 | 36 | 11,160 |
| December | 187 | 21,687 | 182 | 21,188 | 5 | 634 | 60 | 13,086 | 21 | 6,680 | 19 | 6,976 |
| Total (Year) | 2,480 | 310,976 | 2,345 | 298,960 | 97 | 16,847 | 827 | 312,404 | 266 | 67,437 | 562 | 244,967 |

*Data for January to April for Class 1 revised.

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FOR IMMEDIATE RELEASE

DEPARTMENT OF COMMERCE

BUREAU OF THE CENSUS

WASHINGTON

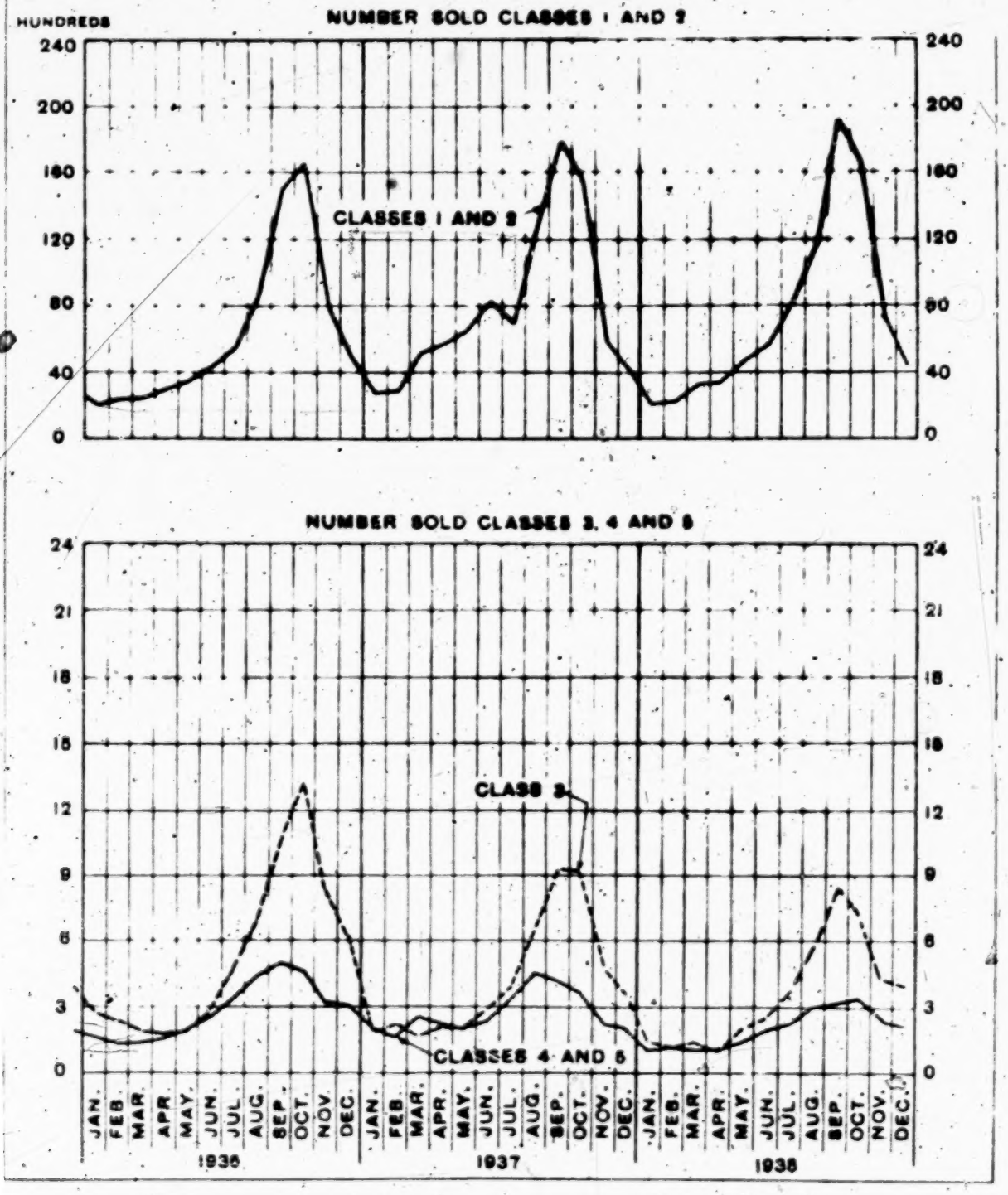
February 13, 1939.

FACTORY SALES OF

# MECHANICAL STOKERS

## DECEMBER 1938

COMPARED WITH PRECEDING MONTHS



FOR IMMEDIATE RELEASE

DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS
WASHINGTON

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# Factory Sales of MECHANICAL STOKERS

## December 1938

## With Summary for 1938

Statistics on factory sales of mechanical stokers, based on data reported by 118 manufacturers for 1938 and 108 for 1937 and 1936, were released today by Director William L. Austin, Bureau of the Census, Department of Commerce. Class 1 stokers were reported for December by 66 manufacturers; Class 2, by 40; Class 3, by 47; Class 4, by 36; and Class 5, by 11. Sales of stokers reported for the month of December 1938 amounted to 4,971 as compared with 7,917 for November 1938; 4,609 for December 1937; and 5,888 for December 1936. The manufacturers whose data are included in these statistics produced approximately 85 percent of the total value of the output of the industry as reported at the Census of Manufactures for 1935.

Mechanical stokers on the schedule form used in 1938 and 1937 are classified, by use, as follows:

Class 1 for residential use (bituminous and anthracite).
Class 2 for small apartment house, flat, and small commercial heating jobs.
Class 3 for apartment house, and general small commercial heating jobs.
Class 4 for large commercial and small high pressure steam plants (small industrial).
Class 5 for high pressure steam plants (industrial).

[A mechanical stoker is a device consisting of a mechanically-operated feeding mechanism and a grate and is used for the purpose of feeding solid fuel into a furnace, admitting air to the fuel for the purpose of combustion and providing a means for removal or discharge of refuse. Hand stokers are not included.]

Table 1. ---STATISTICS FOR DECEMBER 1938, WITH COMPARATIVE DATA FOR NOVEMBER 1938, AND DECEMBER 1937 AND 1936, AND TOTALS FOR THE YEARS 1938, 1937, AND 1936

| Item | 1938 | | 1937 | 1936 | Total (Year) | | |
|---|---|---|---|---|---|---|---|
| | December | November | December | December | 1938 | 1937 | 1936 |
| Stokers, all classes, total number | 4,971 | 7,917 | 4,609 | 5,888 | 98,453 | 101,608 | 86,080 |
| Class 1 (Capacity under 61 pounds of coal per hour): | | | | | | | |
| Total number of stokers | 3,949 | 6,643 | 3,870 | | 84,589 | 87,451 | |
| Bituminous | 3,378 | 5,668 | 3,029 | | 71,978 | 78,377 | |
| Anthracite | 571 | 975 | 841 | | 12,651 | 9,074 | |
| Class 2 (Capacity 61 to 100 pounds of coal per hour): | | | | 4,897 | | | 76,376 |
| Number of stokers | 407 | 608 | 381 | | 8,061 | 8,068 | |
| Class 3 (Capacity 101 to 300 pounds of coal per hour): | | | | | | | |
| Total number of stokers | 398 | 636 | 381 | 616 | 4,386 | 5,402 | 6,331 |
| Total boiler horsepower | 15,954 | 19,007 | 15,396 | | 177,296 | 218,897 | |
| Installed under fire-tube boilers - | | | | | | | |
| Number of stokers | 395 | 632 | 343 | | 4,289 | 4,964 | |
| Boiler horsepower | 15,845 | 18,790 | 15,116 | (1) | 174,109 | 216,907 | (1) |
| Installed under water-tube boilers - | | | | | | | |
| Number of stokers | 3 | 4 | 8 | | 39 | 38 | |
| Boiler horsepower | 115 | 237 | 280 | | 3,187 | 1,390 | |
| Class 4 (Capacity 301 to 1,800 pounds of coal per hour) 1/ | | | | | | | |
| Total number of stokers | 184 | 194 | 167 | 309 | 1,835 | 2,440 | 2,373 |
| Total boiler horsepower | 19,088 | 23,958 | 21,687 | 29,226 | 216,590 | 310,775 | 263,555 |
| Installed under fire-tube boilers - | | | | | | | |
| Number of stokers | 156 | 188 | 182 | 245 | 1,789 | 2,363 | 2,294 |
| Boiler horsepower | 18,580 | 23,118 | 21,155 | 43,227 | 206,980 | 293,909 | 256,668 |
| Installed under water-tube boilers - | | | | | | | |
| Number of stokers | 6 | 6 | 5 | 64 | 64 | | 649 |
| Boiler horsepower | 508 | 837 | 584 | 38,999 | 9,582 | 16,841 | 276,687 |
| Class 5 (Capacity 1,801 pounds of coal per hour and over) : | | | | | | | |
| Total number of stokers | 33 | 34 | 40 | | 582 | 827 | |
| Total boiler horsepower | 21,038 | 10,578 | 18,056 | | 203,470 | 313,404 | |
| Installed under fire-tube boilers - | | | | | | | |
| Number of stokers | 14 | 13 | 21 | (8) | 190 | 286 | (2) |
| Boiler horsepower | 3,980 | 3,264 | 6,480 | | 55,222 | 87,437 | |
| Installed under water-tube boilers - | | | | | | | |
| Number of stokers | 41 | 21 | 19 | | 392 | 568 | |
| Boiler horsepower | 17,118 | 7,314 | 6,976 | | 150,848 | 248,967 | |

1/ Not called for on schedule.
2/ Class 4, as used in 1936, comprised stokers with capacity of over 300 pounds of coal per hour, and data are practically equivalent to data for present Classes 4 and 5 combined.

-2111-

Factory Sales of
MECHANICAL STOKERS - Continued

Table 2.---DETAILED STATISTICS, BY MONTHS, 1938

| Year and Month | Class 1 Number | | | Class 2 | CLASS 3 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Total | | INSTALLED UNDER | | | |
| | | | | | | | Fire-tube boilers | | Water-tube boilers | |
| | Total | Bituminous | Anthracite | Number | Number | Horsepower | Number | Horsepower | Number | Horsepower |
| 1938 | | | | | | | | | | |
| January | 1,955 | 1,612 | 343 | 803 | 161 | 7,167 | 160 | 6,997 | 1 | 150 |
| February | 2,128 | 1,642 | 461 | 171 | 116 | 4,667 | 116 | 4,667 | - | - |
| March | 3,393 | 2,993 | 400 | 237 | 146 | 6,089 | 146 | 6,089 | - | - |
| April | 3,273 | 2,910 | 363 | 148 | 101 | 4,716 | 99 | 4,616 | 2 | 100 |
| May | 4,437 | 3,997 | 440 | 185 | 199 | 8,588 | 199 | 8,588 | - | - |
| June | 5,366 | 4,544 | 821 | 271 | 258 | 10,999 | 256 | 10,899 | 2 | 98 |
| July | 8,098 | 6,754 | 1,319 | 379 | 391 | 18,637 | 371 | 18,637 | - | - |
| August | 11,320 | 9,923 | 1,457 | 602 | 573 | 25,691 | 567 | 23,891 | 6 | 1,800 |
| September | 13,350 | 15,409 | 2,921 | 950 | 846 | 31,615 | 841 | 31,394 | 5 | 221 |
| October | 12,728 | 13,448 | 2,280 | 890 | 711 | 29,504 | 707 | 29,007 | 14 | 497 |
| November | 6,643 | 5,668 | 975 | 608 | 439 | 19,009 | 438 | 18,770 | 1 | 239 |
| December | 3,947 | 3,376 | 571 | 407 | 388 | 15,984 | 386 | 15,868 | 2 | 116 |
| Total (Year) | 84,629 | 71,978 | 12,651 | 5,061 | 4,328 | 199,296 | 4,289 | 196,189 | 39 | 3,107 |

| Year and Month | CLASS 4 | | | | | | CLASS 5 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | TOTAL | | INSTALLED UNDER | | | | TOTAL | | INSTALLED UNDER | | | |
| | | | Fire-tube boilers | | Water-tube boilers | | | | Fire-tube boilers | | Water-tube boilers | |
| | Number | Horsepower | Number | Horsepower | Number | Horsepower | Number | Horsepower | Number | Horsepower | Number | Horsepower |
| 1938 | | | | | | | | | | | | |
| January | 72 | 10,008 | 67 | 9,434 | 5 | 574 | 32 | 10,467 | 9 | 1,557 | 23 | 8,910 |
| February | 73 | 10,035 | 65 | 8,670 | 8 | 1,365 | 39 | 14,631 | 11 | 3,546 | 28 | 11,085 |
| March | 55 | 8,818 | 49 | 8,054 | 6 | 764 | 51 | 19,438 | 3 | 1,380 | 48 | 18,058 |
| April | 80 | 6,650 | 57 | 6,693 | 3 | 457 | 46 | 16,806 | 14 | 4,565 | 32 | 12,241 |
| May | 92 | 11,696 | 88 | 10,786 | 4 | 910 | 46 | 14,476 | 18 | 4,586 | 28 | 9,890 |
| June | 120 | 17,588 | 145 | 16,718 | 5 | 810 | 44 | 13,154 | 21 | 4,680 | 23 | 8,474 |
| July | 176 | 20,153 | 173 | 19,762 | 3 | 391 | 63 | 22,112 | 19 | 5,054 | 43 | 17,058 |
| August | 238 | 29,888 | 232 | 28,972 | 6 | 916 | 66 | 24,508 | 17 | 4,427 | 29 | 10,078 |
| September | 267 | 25,235 | 260 | 23,889 | 7 | 1,346 | 58 | 19,796 | 19 | 4,891 | 40 | 14,904 |
| October | 274 | 30,419 | 268 | 28,709 | 6 | 710 | 88 | 28,601 | 38 | 11,402 | 36 | 15,099 |
| November | 194 | 23,955 | 188 | 23,118 | 6 | 837 | 34 | 10,878 | 13 | 3,564 | 21 | 7,314 |
| December | 164 | 19,065 | 158 | 18,560 | 6 | 505 | 56 | 21,038 | 14 | 3,930 | 41 | 17,112 |
| Total (Year) | 1,833 | 216,590 | 1,769 | 206,986 | 64 | 9,585 | 569 | 203,490 | 190 | 53,582 | 392 | 150,248 |

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DEPARTMENT OF COMMERCE

FOR IMMEDIATE RELEASE
February 8, 1940

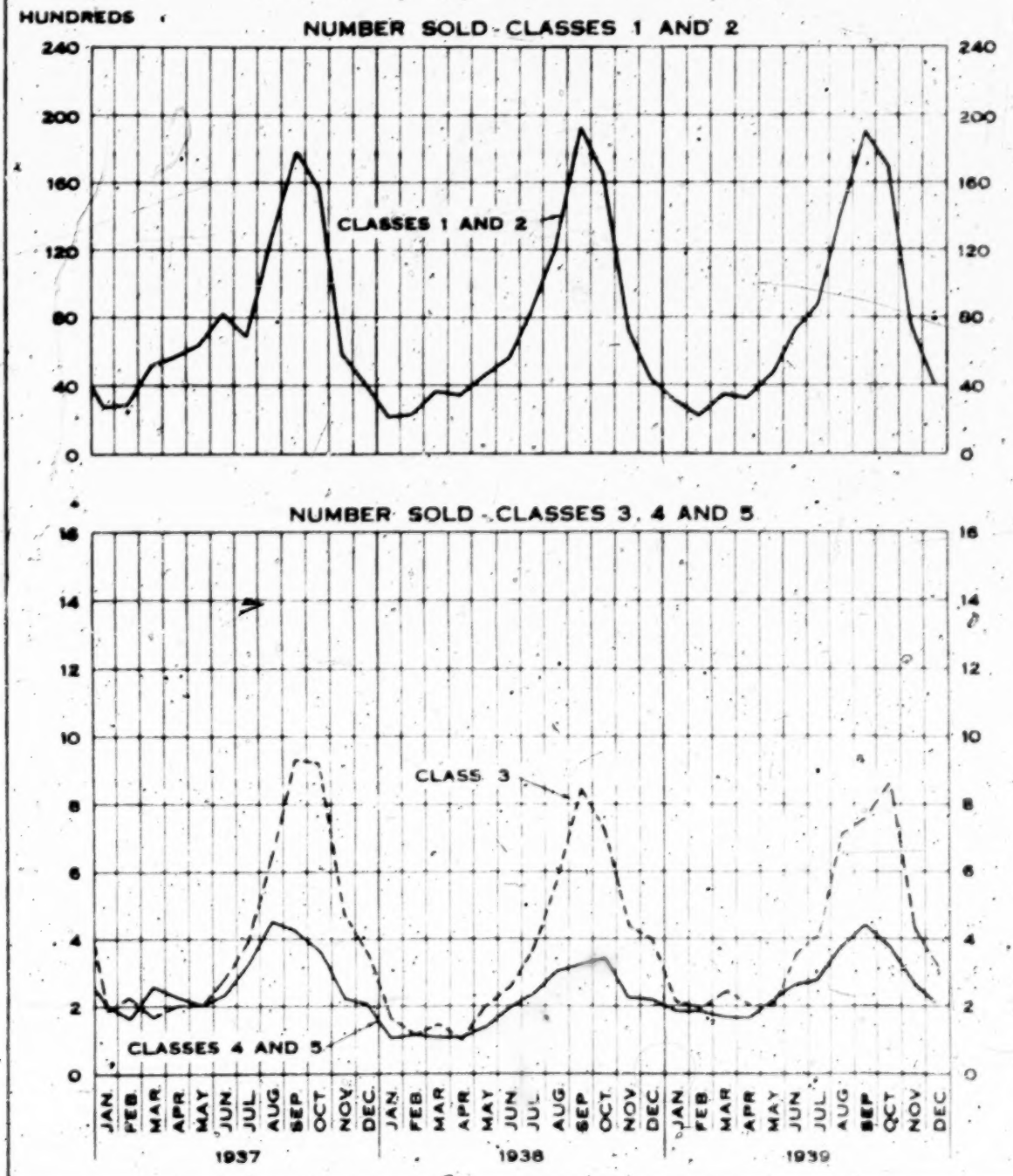
BUREAU OF THE CENSUS
WASHINGTON

CURRENT STATISTICAL SERVICE

# FACTORY SALES OF MECHANICAL STOKERS

## DECEMBER 1939

COMPARED WITH PRECEDING MONTHS



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FOR IMMEDIATE RELEASE

DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS
WASHINGTON

CURRENT STATISTICAL SERVICE

# Factory Sales of MECHANICAL STOKERS

## December 1939

Statistics on factory sales of mechanical stokers, based on data reported by 101 manufacturers for 1939, 118 for 1938 and 108 for 1937, were released today by Director William L. Austin, Bureau of the Census, Department of Commerce. Of the manufacturers reporting in 1938, 11 have discontinued this line. Class 1 stokers were reported for December 1939 by 60 manufacturers, Class 2, by 39; Class 3, by 30; Class 4, by 32; and Class 5, by 18. Sales of stokers reported for the month of December 1939 amounted to 4,969 as compared with 8,481 for November 1939; 4,971 for December 1938; and 4,809 for December 1937. The manufacturers whose data are included in these statistics produced approximately 95 percent of the total value of the output of the industry as reported in the Census of Manufactures for 1937.

Mechanical stokers are classified, by use, as follows:

Class 1 for residential use (bituminous and anthracite).
Class 2 for small apartment house, flat, and small commercial heating jobs.
Class 3 for apartment house, and general small commercial heating jobs.
Class 4 for large commercial and small high pressure steam plants (small industrial).
Class 5 for high pressure steam plants (industrial).

A mechanical stoker is a device consisting of a mechanically-operated feeding mechanism and a grate and is used for the purpose of feeding solid fuel into a furnace, admitting air to the fuel for the purpose of combustion and providing a means for removal or discharge of refuse. Hand stokers are not included.

| Item | 1939 | | 1938 | 1937 | Total, (Year) | | |
|---|---|---|---|---|---|---|---|
| | December | November | December | December | 1939 | 1938 | 1937 |
| Stokers, all classes, total number | 4,969 | *8,481 | 4,971 | 4,809 | 104,[illegible] | 96,435 | 101,808 |
| Class 1 (capacity under 62 pounds of coal per hour) | | | | | | | |
| Total number of stokers | 4,049 | *7,154 | 3,947 | 3,670 | 80,108 | 84,439 | 87,451 |
| Bituminous | 3,370 | *6,093 | 3,306 | 3,029 | 68,332 | 71,998 | 78,377 |
| Anthracite | 679 | *1,061 | 641 | 641 | 11,776 | 12,441 | 9,074 |
| Class 2 (capacity 61 to 100 pounds of coal per hour) | | | | | | | |
| Number of stokers | 388 | *640 | 407 | 381 | 8,137 | 9,081 | 6,068 |
| Class 3 (capacity 101 to 300 pounds of coal per hour) | | | | | | | |
| Total number of stokers | 331 | 431 | 398 | 381 | 4,917 | 4,528 | 5,009 |
| Total boiler horsepower | 14,256 | 17,843 | 15,984 | 15,396 | 200,815 | 177,296 | 218,297 |
| Installed under fire-tube boilers- | | | | | | | |
| Number of stokers | 329 | 428 | 396 | 343 | 4,864 | 4,389 | 4,944 |
| Boiler horsepower | 14,163 | 17,158 | 15,868 | 15,116 | 199,178 | 176,109 | 216,907 |
| Installed under water-tube boilers- | | | | | | | |
| Number of stokers | 2 | 3 | 3 | 8 | 48 | 39 | 38 |
| Boiler horsepower | 90 | 108 | 116 | 280 | 1,637 | *1,187 | 1,390 |
| Class 4 (capacity 301 to 1,800 pounds of coal per hour | | | | | | | |
| Total number of stokers | 154 | 191 | 144 | 187 | 2,894 | 1,838 | 3,480 |
| Total boiler horsepower | 17,760 | 23,865 | 19,088 | 21,887 | 272,838 | 216,870 | 310,774 |
| Installed under fire-tube boilers- | | | | | | | |
| Number of stokers | 123 | 178 | 138 | 122 | 2,[illegible] | 1,[illegible] | 2,[illegible] |
| Boiler horsepower | 17,688 | 21,232 | 18,880 | 21,139 | 268,[illegible] | 206,[illegible] | 293,709 |
| Installed under water-tube boilers- | | | | | | | |
| Number of stokers | 1 | 13 | 8 | 8 | 93 | 64 | 97 |
| Boiler horsepower | 100 | 2,050 | 808 | 804 | 13,868 | 9,885 | 16,887 |
| Class 5 (capacity 1,801 pounds of coal per hour and over) | | | | | | | |
| Total number of stokers | 53 | 78 | 98 | 40 | 824 | 581 | 827 |
| Total boiler horsepower | 83,883 | 88,673 | 83,038 | 13,084 | 330,334 | 803,470 | 313,604 |
| Installed under fire-tube boilers- | | | | | | | |
| Number of stokers | 10 | 30 | 14 | 31 | 809 | 190 | 860 |
| Boiler horsepower | 3,090 | 6,196 | 3,980 | 6,480 | 54,104 | 53,823 | 67,459 |
| Installed under water-tube boilers- | | | | | | | |
| Number of stokers | 43 | 48 | 41 | 19 | 488 | 398 | 543 |
| Boiler horsepower | 18,163 | 82,877 | 17,113 | 6,576 | 276,843 | 180,848 | 245,947 |

* Revised.

1911

(3)

DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS
WASHINGTON

Factory Sales of
MECHANICAL STOKERS - Continued

Table 2.—DETAILED STATISTICS, BY MONTHS, 1939

| Year and Month | Class 1 Number | | | Class 2 | CLASS 3 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Total | | INSTALLED UNDER | | | |
| | | | | | | | Fire-tube boilers | | Water-tube boilers | |
| | Total | Bituminous | Anthracite | Number | Number | Horsepower | Number | Horsepower | Number | Horsepower |
| 1939 | | | | | | | | | | |
| January | *8,937 | *2,443 | 7484 | *268 | 220 | 8,695 | 205 | 8,439 | 3 | 256 |
| February | *8,046 | *1,886 | 9869 | 197 | 193 | 7,912 | 188 | 7,888 | 1 | 30 |
| March | *9,300 | *2,895 | *345 | 285 | 240 | 9,873 | 238 | 9,803 | 2 | 70 |
| April | *9,052 | *2,[illegible] | [illegible] | 285 | 201 | 7,527 | 196 | 7,387 | 5 | 140 |
| May | *6,639 | *2,999 | *330 | [illegible] | 200 | 8,411 | 200 | 8,411 | — | — |
| June | *6,972 | *3,980 | *952 | *443 | *241 | *15,094 | *241 | *15,094 | — | — |
| July | *8,272 | *7,141 | *1,351 | 4490 | *413 | *27,888 | 409 | *27,688 | 4 | 240 |
| August | *13,288 | *11,752 | *1,533 | *838 | 710 | 39,287 | 699 | 38,938 | 11 | 349 |
| September | *18,395 | *16,180 | *2,220 | *1,095 | 761 | 30,914 | 734 | 30,708 | 7 | 226 |
| October | *16,107 | *14,046 | *2,061 | *1,072 | 821 | 33,836 | 815 | 33,595 | 6 | 241 |
| November | *7,134 | *4,893 | *1,041 | *440 | 431 | 17,283 | 428 | 17,138 | 3 | 145 |
| December | 4,049 | 3,370 | 679 | 388 | 331 | 14,365 | 329 | 14,165 | 2 | 10 |
| Total (Year) | 90,108 | 78,331 | 11,776 | 6,137 | 4,912 | 200,813 | 4,856 | 199,272 | 44 | 1,541 |

| Year and Month | CLASS 4 | | | | | | CLASS 5 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | TOTAL | | INSTALLED UNDER | | | | TOTAL | | INSTALLED UNDER | | | |
| | | | Fire-tube boilers | | Water-tube boilers | | | | Fire-tube boilers | | Water-tube boilers | |
| | Number | Horsepower | Number | Horsepower | Number | Horsepower | Number | Horsepower | Number | Horsepower | Number | Horsepower |
| 1939 | | | | | | | | | | | | |
| January | 144 | 17,077 | 139 | 16,317 | 5 | 760 | 43 | 17,832 | 4 | 1,525 | 39 | 16,307 |
| February | 139 | 15,160 | 137 | 14,860 | 2 | 300 | 37 | 23,772 | 13 | 3,377 | 24 | 20,395 |
| March | 122 | 14,234 | 116 | 13,193 | 6 | 1,041 | 46 | 20,977 | 6 | 2,550 | 40 | 18,427 |
| April | 115 | 12,[illegible] | 104 | 11,459 | 11 | 1,430 | 49 | 19,631 | 10 | 2,193 | 39 | 17,438 |
| May | 148 | 17,[illegible] | 139 | 16,293 | 9 | 1,393 | 48 | 31,611 | 24 | 3,739 | 33 | 27,872 |
| June | 160 | 18,[illegible] | 150 | 16,534 | 10 | 1,608 | 47 | 34,305 | 14 | 3,387 | 33 | 30,918 |
| July | [illegible] | [illegible] | [illegible] | [illegible] | 9 | 1,380 | 48 | 38,773 | 25 | 9,143 | 23 | 29,630 |
| August | 339 | 34,[illegible] | [illegible] | 35,[illegible] | 4 | 384 | 37 | 27,480 | 16 | 3,400 | 21 | 24,080 |
| September | 334 | 41,[illegible] | 316 | 38,[illegible] | 18 | 2,730 | 105 | 44,777 | 29 | 6,764 | 76 | 38,013 |
| October | [illegible] | [illegible] | [illegible] | [illegible] | 5 | 677 | 93 | 31,[illegible] | 25 | 8,[illegible] | 68 | 22,805 |
| November | [illegible] | [illegible] | [illegible] | [illegible] | 13 | 2,030 | 75 | 28,[illegible] | 30 | 6,196 | 45 | 22,277 |
| December | 164 | 19,[illegible] | 153 | 17,[illegible] | 1 | 100 | 53 | 21,253 | 10 | 3,090 | 43 | 18,163 |
| Total (Year) | 2,[illegible] | [illegible] | 1,303 | 238,907 | 93 | 13,866 | 834 | 330,354 | 228 | 54,365 | 628 | 276,248 |

* Revised.

1939

630

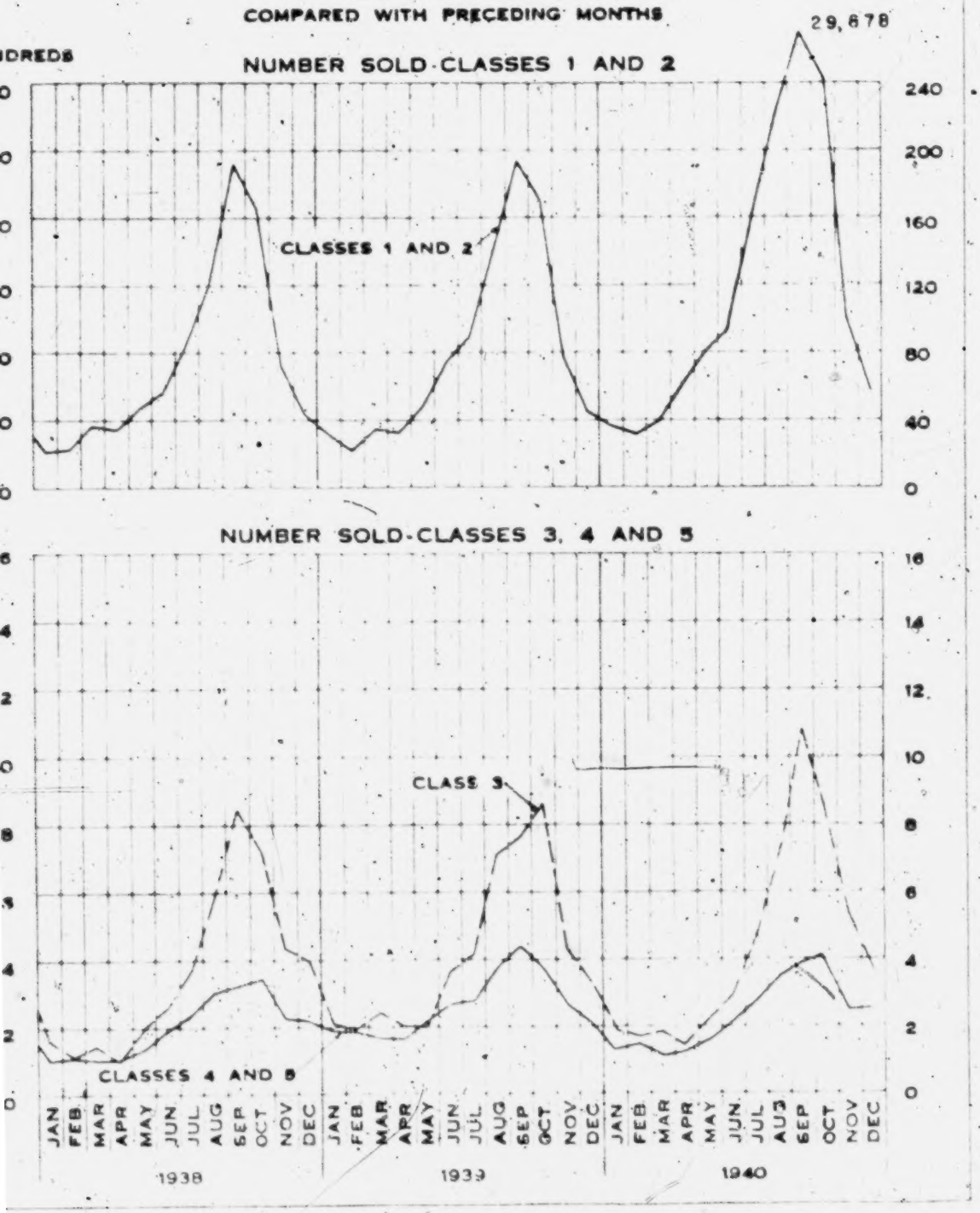
DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS
WASHINGTON

FOR IMMEDIATE RELEASE
February 10, 1941

CURRENT STATISTICAL SERVICE

# FACTORY SALES OF MECHANICAL STOKERS

## DECEMBER 1940
### COMPARED WITH PRECEDING MONTHS



FOR IMMEDIATE RELEASE

U. S. DEPARTMENT OF COMMERCE
Bureau of the Census
Washington

CURRENT STATISTICAL SERVICE

681

# Factory Sales of MECHANICAL STOKERS

December 1940

Monthly statistics on factory sales of mechanical stokers were released today by Acting Director Vergil D. Reed, Bureau of the Census, Department of Commerce. Data were reported by 107 manufacturers for 1940, 101 for 1939, and 112 for 1938. For December 1940, Class 1 stokers were reported by 67 manufacturers; Class 2, by 39; Class 3, by 40; Class 4, by 27; and Class 5, by 10. Sales of stokers reported for the month of December 1940 amounted to 6,357 as compared with 10,845 for November 1940, 4,969 for December 1939, and 4,971 for December 1938. The manufacturers whose data are included in these statistics produced approximately 95 percent of the total value of the output of the industry as reported for the Census of Manufactures for 1937.

Mechanical stokers are classified, by use, as follows:

Class 1 for residential use (bituminous and anthracite).
Class 2 for small apartment house, flat, and small commercial heating jobs (bituminous and anthracite).
Class 3 for apartment house, and general small commercial heating jobs.
Class 4 for large commercial and small high pressure steam plants (small industrial).
Class 5 for high pressure steam plants (industrial).

A mechanical stoker is a device consisting of a mechanically-operated feeding mechanism and a grate and is used for the purpose of feeding solid fuel into a furnace, admitting air to the fuel for the purpose of combustion, and providing a means for removal or discharge of refuse. Hand stokers are not included.

| Item | 1940 | | 1939 | 1938 | Total (year) | | |
|---|---|---|---|---|---|---|---|
| | December | November* | December | December | 1940* | 1939 | 1938 |
| Stokers, all classes, total number | 6,357 | 10,845 | 4,969 | 4,971 | 151,908 | 104,239 | 96,435 |
| Class 1 (capacity under 61 pounds of coal per hour): | | | | | | | |
| Total number of stokers | 5,380 | 9,243 | 4,049 | 3,947 | 136,084 | 90,108 | 84,629 |
| Bituminous | 4,849 | 8,284 | 3,378 | 3,376 | 123,167 | 78,332 | 71,978 |
| Anthracite | 671 | 959 | 679 | 571 | 12,917 | 11,776 | 12,651 |
| Class 2 (capacity 61 to 100 pounds of coal per hour): | | | | | | | |
| Total number of stokers | 414 | 819 | 382 | 407 | 8,734 | 6,137 | 5,061 |
| Bituminous | 389 | 788 | (1) | (1) | 7,784 | (1) | (1) |
| Anthracite | 25 | 31 | (1) | (1) | 970 | (1) | (1) |
| Class 3 (capacity 101 to 300 pounds of coal per hour): | | | | | | | |
| Total number of stokers | 369 | 334 | 331 | 398 | 5,849 | 4,912 | 4,389 |
| Total boiler horsepower | 14,676 | 22,236 | 14,855 | 15,954 | 208,388 | 200,815 | 177,296 |
| Installed under fire-tube boilers - | | | | | | | |
| Number of stokers | 369 | 332 | 329 | 395 | 5,800 | 4,866 | 4,289 |
| Boiler horsepower | 14,676 | 22,018 | 14,168 | 15,842 | 205,654 | 199,172 | 174,109 |
| Installed under water-tube boilers- | | | | | | | |
| Number of stokers | --- | 2 | 2 | 3 | 49 | 46 | 39 |
| Boiler horsepower | --- | 280 | 90 | 112 | 2,732 | 1,643 | 3,187 |
| Class 4 (capacity 301 to 1,200 pounds of coal per hour): | | | | | | | |
| Total number of stokers | 167 | 169 | 154 | 164 | 1,880 | 2,296 | 1,855 |
| Total boiler horsepower | 18,063 | 20,353 | 19,788 | 19,098 | 230,808 | 272,856 | 218,570 |
| Installed under fire-tube boilers - | | | | | | | |
| Number of stokers | 162 | 168 | 188 | 188 | 1,811 | 2,205 | 1,789 |
| Boiler horsepower | 17,683 | 19,853 | 17,688 | 18,580 | 219,397 | 258,967 | 208,985 |
| Installed under water-tube boilers- | | | | | | | |
| Number of stokers | 5 | 1 | 1 | 6 | 69 | 95 | 64 |
| Boiler horsepower | 380 | 500 | 100 | 508 | 10,811 | 13,868 | 9,585 |
| Class 5 (capacity 1,201 pounds of coal per hour and over): | | | | | | | |
| Total number of stokers | 67 | 80 | 53 | 52 | 939 | 834 | 582 |
| Total boiler horsepower | 33,606 | 35,134 | 21,253 | 21,032 | 339,848 | 380,364 | 305,470 |
| Installed under fire-tube boilers - | | | | | | | |
| Number of stokers | 21 | 17 | 10 | 14 | 288 | 208 | 190 |
| Boiler horsepower | 4,068 | 3,629 | 3,090 | 3,920 | 61,984 | 54,106 | 53,222 |
| Installed under water-tube boilers- | | | | | | | |
| Number of stokers | 66 | 63 | 43 | 41 | 670 | 628 | 392 |
| Boiler horsepower | 29,538 | 31,505 | 18,163 | 17,112 | 277,864 | 326,248 | 150,248 |

1/ Data not available.
* Revised for June, October and November.

•(3)

U. S. DEPARTMENT OF COMMERCE
Bureau of the Census
Washington

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Factory Sales of
MECHANICAL STOKERS - Continued

Table 2.—DETAILED STATISTICS, BY MONTHS, 1940

| Year and month | Class 1 - Number | | | Class 2 | CLASS 3 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Total | | INSTALLED UNDER— | | | |
| | | | | | | | Fire-tube boilers | | Water-tube boilers | |
| | Total | Bituminous | Anthracite | Number | Number | Horsepower | Number | Horsepower | Number | Horsepower |
| 1940 | | | | | | | | | | |
| January | 3,430 | 2,927 | 503 | 376 | 190 | 6,922 | 189 | 6,797 | 1 | 125 |
| February | 3,226 | 2,915 | 311 | 261 | 169 | 6,361 | 167 | 6,361 | — | — |
| March | 3,916 | 3,484 | 432 | 245 | 181 | 7,139 | 179 | 7,048 | 2 | 91 |
| April | 6,115 | 5,379 | 736 | 228 | 147 | 6,392 | 143 | 6,337 | 2 | 55 |
| May | 7,700 | 6,997 | 703 | 331 | 225 | 7,759 | 216 | 7,227 | 9 | 532 |
| June | •9,129 | •8,148 | 981 | •413 | •295 | •12,307 | •293 | •12,436 | 2 | 71 |
| July | 15,390 | 14,183 | 1,207 | 715 | 460 | 18,266 | 446 | 17,630 | 14 | 616 |
| August | 20,682 | 19,015 | 1,667 | 1,691 | 744 | 29,676 | 731 | 28,804 | 13 | 872 |
| September | 28,076 | 25,992 | 2,084 | 1,802 | 1,073 | 42,525 | 1,073 | 42,525 | — | — |
| October | •22,857 | •21,194 | 1,663 | •1,459 | •864 | •33,747 | •860 | •33,597 | 4 | 150 |
| November | •9,243 | •8,284 | 959 | 819 | •534 | •22,236 | •532 | •22,016 | 2 | 220 |
| December | 5,320 | 4,649 | 671 | 414 | 369 | 14,676 | 369 | 14,676 | — | — |
| Total (year) | 135,084 | 123,167 | 11,917 | 8,754 | 5,249 | 208,386 | 5,200 | 205,654 | 49 | 2,732 |

| Year and month | CLASS 4 | | | | | | CLASS 5 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | TOTAL | | INSTALLED UNDER— | | | | TOTAL | | INSTALLED UNDER— | | | |
| | | | Fire-tube boilers | | Water-tube boilers | | | | Fire-tube boilers | | Water-tube boilers | |
| | Number | Horsepower | Number | Horsepower | Number | Horsepower | Number | Horsepower | Number | Horsepower | Number | Horsepower |
| 1940 | | | | | | | | | | | | |
| January | 91 | 11,021 | 89 | 10,535 | 2 | 486 | 37 | 14,494 | 15 | 4,210 | 22 | 10,284 |
| February | 104 | 13,967 | 102 | 13,767 | 2 | 200 | 45 | 14,624 | 16 | 4,095 | 29 | 10,529 |
| March | 61 | 8,026 | 58 | 7,615 | 3 | 411 | 90 | 22,151 | 18 | 5,102 | 32 | 17,049 |
| April | 79 | 11,797 | 71 | 10,162 | 8 | 1,635 | 46 | 17,680 | 18 | 4,961 | 28 | 12,919 |
| May | 88 | 10,609 | 79 | 9,367 | 9 | 1,242 | 73 | 31,723 | 9 | 2,035 | 64 | 29,688 |
| June | 143 | 18,340 | 132 | 16,672 | 11 | 1,668 | 75 | 20,168 | 21 | 5,064 | 54 | 15,104 |
| July | 178 | 24,887 | 170 | 22,817 | 8 | 2,070 | 97 | 33,539 | 19 | 4,410 | 78 | 29,129 |
| August | 260 | 29,752 | 252 | 28,895 | 8 | 857 | 92 | 28,699 | 22 | 3,324 | 70 | 25,345 |
| September | 265 | 30,793 | 261 | 30,306 | 4 | 487 | 121 | 50,044 | 44 | 10,732 | 77 | 39,312 |
| October | •275 | •32,600 | •270 | •31,925 | 5 | 675 | 135 | 47,824 | 48 | 10,392 | 87 | 37,432 |
| November | 169 | •20,353 | 165 | •19,853 | 4 | 500 | 80 | 25,134 | 17 | 3,527 | 63 | 21,607 |
| December | 167 | 18,063 | 162 | 17,483 | 5 | 580 | 87 | 33,608 | 21 | 4,082 | 66 | 29,526 |
| Total (year) | 1,880 | 230,208 | 1,811 | 219,397 | 69 | 10,811 | 938 | 339,848 | 268 | 61,924 | 670 | 277,924 |

• Revised.

# A F F I D A V I T

STATE OF ILLINOIS :
: ss
COUNTY OF COOK :

James F. Chambliss, being duly sworn, deposes and says that he is the Assistant Secretary and Assistant Treasurer of The Mercoid Corporation; that the following table sets forth the number of Mercoid fire maintaining controls sold during each year of the years indicated on the following table as taken from the records of The Mercoid Corporation:

| | |
|---|---|
| 1931 | 595 |
| 1932 | 1,003 |
| 1933 | 1,721 |
| 1934 | 2,495 |
| 1935 | 2,573 |
| 1936 | 4,431 |
| 1937 | 7,374 |
| 1938 | 6,169 |
| 1939 | 6,473 |
| 1940 | 7,345 |

James F. Chambliss

Sworn to and subscribed before me this 29th day of April, 1941.

Barbara A. Ericson

Notary Public

My commission expires 12/2/42

MINNEAPOLIS-HONEYWELL REGULATOR CO.
EXECUTIVE OFFICES
MINNEAPOLIS MINNESOTA U.S.A.
FACTORIES MINNEAPOLIS, MINN.
WABASH, IND.

W. SWEATT
SIDENT

SUBSIDIARIES
THE BROWN INSTRUMENT CO.
PHILADELPHIA, PA.
MINNEAPOLIS-HONEYWELL REGULATOR CO. LTD.
TORONTO, CANADA
N.V. NEDERLANDSCHE
MINNEAPOLIS HONEYWELL CO.
AMSTERDAM, HOLLAND

Sept. 16, 1935.

**Defendant's Exhibit P-P**

Mr. Ira E. McCabe,
The Mercoid Corporation,
4201 Belmont Ave.,
Chicago, Illinois.

Dear Mac:-

I have had some wires from Walter Cross at Kansas City, asking for terms for license for you under the Cross patents. I have told him I would much prefer to arrange a license with you direct rather than through third parties, and if you are interested, I would be very glad indeed to get together with you and work out an arrangement which I feel would be satisfactory to you.

Will you let me hear from you.

Yours very truly,

Harold

H.W.Sweatt
VT

TELEPHONE
MAIN 7326

MID-CONTINENT INVESTMENT COMPANY
700 BALTIMORE AVENUE
KANSAS CITY MISSOURI

September 17, 1935

Mr. McCabe
c/o The Mercoid Corporation
4201 Belmont Avenue
Chicago, Illinois

Dear Mr. McCabe:

I have been in touch with the Minneapolis-Honeywell Regulator Company by wire during the past week and have just received word from them that they would much prefer taking up the matter of terms of license with you directly.

Mr. Sweatt advised that he had written you on the Sixteenth concerning this. I presume he will be able to get you all the information you require as to requirements for a license.

Would you mind getting in touch with me as soon as he has given you the proper information or if I can do anything for you to expedite your obtaining any of the information.

Kind personal regards,

MID-CONTINENT INVESTMENT CO.

By:

WMC:RL

MINNEAPOLIS-HONEYWELL REGULATOR CO
EXECUTIVE OFFICES
MINNEAPOLIS MINNESOTA U S A
FACTORIES MINNEAPOLIS MINN
WABASH IND

HAROLD W SWEATT
PRESIDENT

SUBSIDIARIES
THE BROWN INSTRUMENT CO
PHILADELPHIA PA
MINNEAPOLIS HONEYWELL REGULATOR CO LTD
TORONTO CANADA
N V NEDERLANDSCHE
MINNEAPOLIS HONEYWELL CO
AMSTERDAM HOLLAND

November 6, 1935.

The Mercoid Corporation,
4201 Belmont Avenue,
Chicago, Ill.

Attention: Mr. Ira E. McCabe or Mr. L.B. Reed.

Gentlemen:-

I am enclosing herewith draft of proposed sub-license agreement on the ross patents, which our Patent Department has drawn up. Took them longer to get this out than I anticipated, and I hope this delay has not inconvenienced any of you down there.

Yours very truly,

Harold W Sweatt

H.W. Sweatt
VT

MINNEAPOLIS-HONEYWELL REGULATOR CO.
EXECUTIVE OFFICES
MINNEAPOLIS, MINNESOTA, U. S. A.
FACTORIES MINNEAPOLIS, MINN.
WABASH, IND.

HAROLD W. SWEATT
PRESIDENT

SUBSIDIARIES
THE BROWN INSTRUMENT CO.
PHILADELPHIA, PA.
MINNEAPOLIS-HONEYWELL REGULATOR CO.
TORONTO, CANADA
N. V. NEDERLANDSCHE
MINNEAPOLIS-HONEYWELL CO.
AMSTERDAM, HOLLAND

December 12, 1935.

Mr. Ira McCabe,
The Mercoid Corporation,
4201 Belmont Avenue,
Chicago, Illinois.

Dear Ira:-

Mr. Fisher returned from Chicago, and we have discussed points that came up in your meeting. Mr. Fisher has already handled the matter of extension and further patent data that Langdon wanted to see.

I wanted to, however, give you my views on a couple of other questions that were raised in this meeting.

First, It was very strongly my thought, as far as Cross is concerned, that we should go ahead with him on the present basis with no effort at this time to make any change in our contractual relations with Cross. We feel that we are in a stronger position to push Cross as we are with the thought that the pressure that we can exert a little later on (cancellation if he will not play ball with us) would be stronger than any arguments about stopping at the present time. I want him to be assured of his revenue for next year, consequently I would not want to suggest any changes to Cross now, preferring to do it later in the year if we do not get suitable action, which I have every confidence we will get.

I understand that your general proposal was that we would try to make an arrangement, with Cross if he was unable to stop the competition in this field that we would not be obligated to minimum royalties unless we earned them. This is the point that I feel we can change better later on than at the present time.

Second - I understand from Mr. Fisher that you suggested to him that you might be interested in taking a license only under Cross at a lower rate, possibly not licensing under some of these other features. This proposition is not available to you at a lower rate. You, of course, can take only the license under Cross if you want it, but the rate would be the same as if we gave you the other material. We would not be interested in a license on any other basis, and we feel that with our investment expenses that we have had in this matter that the proposal we have offered is a very reasonable one.

Sincerely yours,
MINNEAPOLIS-HONEYWELL REGULATOR CO.

Harold W Sweatt

H.W. Sweatt - President.

HWS:JT

cc Scott Lemmon 12-A-35 w/ file

1088 DEFENDANT'S EXHIBIT QQ.

Sub-License Agreement.

Agreement made this day of , 1935, by and between Minneapolis-Honeywell Regulator Company, a corporation organized and existing under the laws of the State of Delaware and having a principal place of business at 2727 Fourth Avenue South, Minneapolis, Hennepin County, Minnesota, hereinafter called "Minneapolis", and The Mercoid Corporation, a corporation organized and existing under the laws of the State of , and having a principal place of business at 4201 Belmont Avenue, Chicago, Cook County, Illinois, hereinafter called "Mercoid", Witnesseth:

Whereas, Minneapolis is the present owner of the sole and exclusive right and license to make, use and sell and to sub-license others to make, use and sell the inventions disclosed in the following two Letters Patent of the United States as applied to coal stokers:

| Number | Inventor | Granted | Invention |
|---|---|---|---|
| 1,758,146 | Walter M. Cross | May 13, 1930 | Domestic Heating System |
| 1,758,147 | Walter M. Cross | May 13, 1930 | Heating System Control |

Whereas, Minneapolis acquired such exclusive license with right to grant sub-licenses pursuant to a license agreement entered into by it as such licensee on December 23, 1931, with Cross Coal-O-Matic Company and one Butler Manufacturing Company as Licensors, the former being the owner of the entire right, title and interest in and to said inventions and said patents, subject to and exclusive license to the latter now extinguished;

1089 Whereas, said Cross-Butler-Minneapolis Agreement of December 23rd, 1931 has been modified in part by two subsequent agreements contained in letters dated January 21st, 1933 and June 5th, 1933, the first of which extends the time for making statements and paying royalty fees by Minneapolis as provided in paragraph six (6) therein from the 15th days of January, April, July and October of each year to the 25th days of January, April,

July and October of each year and the second of which modifies paragraph sixteen (16) thereof by striking out the words "become bankrupt or insolvent or enter into any settlement with its creditors, or shall" in lines three (3) and four (4) of said paragraph sixteen (16), whereby Cross and Butler no longer have the right to cancel said Cross-Butler-Minneapolis Agreement in the event Minneapolis should become bankrupt or insolvent or enter into any settlement with its creditors;

Whereas, Minneapolis has the right to terminate said prior license agreement on December 31st of any year and has agreed therein that any sub-licenses granted thereunder shall be terminated coincidentally with its license;

Whereas, Minneapolis is the present owner of the entire right, title and interest in and to a United States Letters Patent No. 1,969,136 granted to David J. Jones for Control System for Stoker Motors, on August 7, 1934, and the invention therein contained, subject only to certain outstanding non-exclusive rights and or licenses heretofore granted;

1090 Whereas, Minneapolis is the owner of the entire right, title and interest in and to a pending patent application filed by one Sylvanus C. Shipley in the United States Patent Office on April 30, 1932, bearing Serial No. 606,440, for improvements in Control Systems for Automatic Stokers, and the invention therein contained, and is also the owner of the entire right, title and interest in and to a divisional application thereof filed August 1, 1934, bearing Serial No. 737,917, for improvements in Thermostatic Switching Mechanism and the invention therein contained, both of said applications being subject to certain outstanding non-exclusive rights and or licenses heretofore granted;

Whereas, Mercoid is desirous of securing a non-exclusive license and sub-license under said patents and applications and Minneapolis is willing to grant such license and sub-license;

Now, Therefore, in consideration of One Dollar ($1.00) in cash, each to the other in hand paid, the receipts whereof are jointly and severally acknowledged, and in consideration of the mutual representations, covenants and agreements herein set out, Minneapolis and Mercoid mutually and severally represent, covenant and agree as follows:

1091

Definitions.

1. That the term "Combustion Stoker Switch" is now known to both parties hereto and is a device, including an automatic electric switching means responsive directly to temperatures of combustion gases or boiler water produced by an automatic coal-fuel stoker and adapted, in combination with other devices and apparatus, for the control of, automatically operated coal fuel stokers, and having at least the function of preventing the extinguishment of its fire when operating under low heat requirement conditions and which switching means is peculiarly adapted for use in the Heating Systems and Controls forming the subject-matter of said three patents and the parent of said two pending applications and such term Combustion Stoker Switch as herein used is only applicable to such device when it bears the license conferring notice recited in Section 16 hereof.

2. That the term "net sales price" for the purposes of this Agreement and as used herein, shall be that sum or amount of money, less all pecuniary discounts and allowances, which is chargeable to, and to be paid by, a buyer for each Combustion Stoker Switch.

Grant.

3. Minneapolis hereby grants Mercoid a non-exclusive license to make and have made for it and to use and to sell said above described "Combustion Stoker Switches" and to use and to sell any and all apparatus, in whole or in part, in combination with such a Combustion Stoker Switch, for use in; or to constitute embodiments of, the inven-
1092 tions covered by said Letters-Patent or any of them or said applications or either of them and the patents to be granted thereon; Provided, however, such non-exclusive license to make, use and sell the Combustion Stoker Switch shown and described in said Shipley application Serial No. 737,917 is restricted to the manufacture, use and sale of said Shipley Combustion Stoker Switch for use only in the systems and system controls shown and described in said patents and applications; and, Provided further, that only those systems or system controls shall be licensed hereunder for which Mercoid shall pay to Minneapolis the hereinafter prescribed royalties, due and payable here-

under for each Combustion Stoker Switch used in each such licensed system or system control; and, Provided further, that no license under any patents or applications or inventions other than those herein recited is hereby granted or implied, except as shall be necessary and essential to the enjoyment of the license by Mercoid.

Duration.

4. The license and sub-license hereby granted Mercoid by Minneapolis shall continue until the expiration of said patents or of that of the patent last granted upon said applications, whichever shall be the longer, and of any reissues thereof, unless this license and sub-license is earlier terminated in accordance with the provisions hereof.

Territory.

5. The license and sub-license hereby granted shall extend throughout the territory of the United States of America and its possessions and, so far as concerns the license hereby granted under said Jones patent and 1093 Shipley applications, they shall additionally extend throughout the territory of the Dominion of Canada.

Assignability.

6. Unless earlier terminated in accordance with the provisions of this Agreement, the license and the sub-license hereby granted shall only be assignable by Mercoid in connection with the sale of all or a major portion of Mercoid's entire assets and good will or in connection with its reorganization or consolidation or merger with another corporation.

Earned Royalty.

7. Mercoid agrees to pay Minneapolis as a minimum earned royalty for each licensed "Combustion Stoker Switch", responsive directly to temperatures of combustion gases and adapted to cooperate with other devices or apparatus to prevent extinguishment of the fire of an automatic coal fuel stoker, sold by or for it, on or after the 1st day of November, 1935, pursuant to the provisions of

this Agreement the sum of One Dollar Twenty Five Cents ($1.25) and, in the event Five Percent (5%) of Mercoid's net sales price of said "Combustion Stoker Switch" shall exceed One Dollar Twenty Five Cents ($1.25), then, and in each such event, the earned royalty for each such switch shall be Five Percent (5%) of such net sales price; and provided further, that the minimum earned royalty for each such licensed switch which is adapted to be responsive to boiler water temperature and is not adapted to be responsive to combustion gases shall be fixed at One Dollars ($1.00) and in the event Five Percent (5%) of Mercoid's net sales price of such boiler-water-responsive switch shall exceed One Dollar ($1.00) then, and in each such event, the earned royalty therefor shall be Five Percent (5%) of such net sales price.

Minimum Annual Royalties.

8. Mercoid agrees to pay during the existence of this sub-license, a minimum guaranteed royalty of One Hundred Fifty Dollars ($150.00) for the period beginning with the execution of this Agreement and ending December 31, 1935, and a minimum guaranteed royalty of Nine Hundred Dollars ($900.00) for the calendar year 1936 and each calendar year thereafter; said initial payment of One Hundred Fifty Dollars ($150.00) shall be due and payable upon the execution of this agreement and each of said minimum guaranteed annual royalties in the amount of Nine Hundred Dollars ($900.00) shall be paid in equal half-yearly payments in advance on January 20, and July 20 of each year; Provided that, in the event of termination of this Agreement as herein provided, said minimum annual royalty payment for the then-current year shall be pro-rated and such pro-rated part for the expired portion of the then-current year shall constitute the limit of liability of Mercoid for minimum annual royalty for such year.

Statements and Payments.

9. Mercoid agrees to pay the earned royalties due hereunder to Minneapolis and to make quarterly statements to Minneapolis on the twentieth (20th) days of January April, July and October of each year during the existence of this Agreement, showing all sales made of

said switches and net prices thereof for the quarterly period ending with the last day of the month preceding each such statement, and Mercoid agrees to accompany each such statement with the earned royalties thereby shown to be due, less any payment of minimum guaranteed royalties theretofore, or then to be, made during the calendar year in which such statement was rendered.

### Examination of Records.

10. Mercoid agrees to keep accurate books of account concerning sales, net prices and transactions pertaining to said Combustion Stoker Switches and agrees that Minneapolis shall be permitted, through certified public accountants, to examine such books of account at reasonable times, it being understood that such examinations shall be limited to sales, prices and transactions of said Combustion Stoker Switches.

### Exceptions to Report of Prices.

11. It is mutually agreed that, so long as the net selling price of Combustion Stoker Switches responsive either to the temperature of the combustion gases or the temperature of the boiler water is less than Fifteen Dollars ($15.00) per device, Mercoid shall be relieved of the obligation to report the net sales prices of each such switch in rendering quarterly reports provided for in Section 9 hereof.

1096

### Definition of "Sold".

12. It is jointly and severally agreed that, for the purposes of this Agreement, said switches shall be considered to be sold when billed out, or if not billed out, then when delivered, or when paid for, if paid for before delivery and it is further so agreed that royalties paid on switches which are lost or damaged in transit or otherwise defective, or returned for credit, and not accepted by the customers, may be deducted from further royalty payments to be made hereunder.

Termination by Mercoid.

13. Mercoid shall have the right to terminate this Agreement on December 31st of any year during its continuance by previous notice thereof in writing, sent registered mail, postage prepaid, to Minneapolis at its last known place of business, not later than the first day of October next preceding whereupon this license shall cease and all rights and liabilities of Mercoid shall terminate without prejudice to any rights of Minneapolis to recover any moneys then due by way of royalties prior to such termination.

Termination by Minneapolis.

14. Minneapolis shall have the right to terminate this Agreement on December thirty-first (31st) of any year during its continuance by previous notice thereof in writing, sent registered mail, postage prepaid, to Mercoid at its last known place of business, not later than the fifteenth (15th) day of September next preceding, whereupon 1097 this Agreement shall cease and all rights and liabilities of Mercoid thereunder shall terminate without prejudice to any rights of Minneapolis to recover any moneys then due by way of royalties prior to such termination; Provided, however, the herein recited right of Minneapolis so to terminate this Agreement is, and shall be, subject to the following limitation and qualification, to-wit, in the event that Minneapolis shall in any year during the continuance of this Agreement have duly notified Mercoid of Minneapolis' election to terminate this Agreement and Mercoid shall desire the continuance of this Agreement, then, Mercoid shall have the right to continue this Agreement in full force and effect by written notice to Minneapolis sent registered mail, postage prepaid, not later than the thirtieth (30th) day after mailing of Minneapolis' such notice, to Minneapolis' last known place of business of such election to continue, whereupon Minneapolis agrees not to terminate said Agreement and not to manufacture or sell said Combustion Stoker Switches for embodiment in the system or systems disclosed in said Cross Patents 1,758,146 and 1,758,147, or either of them, and the rights, obligations, liabilities and other provisions of this Agreement shall continue in full force and effect with the single

exception that each guaranteed minimum annual royalty to be paid by Mercoid to Minneapolis for the next and each succeeding year thereafter shall be increased by Twenty-six Hundred Dollars ($2,600.00); Provided, further, however, in the event that this Agreement shall have been continued and Minneapolis shall have ceased manufacture or sale of said Combustion Stoker Switches and Mercoid 1098 shall have paid said increased guaranteed minimum annual royalty as herein specified, and thereafter Minneapolis shall desire to resume such manufacture and sale, then Minneapolis shall have the right so to resume upon written notice to Mercoid and upon re-payment to Mercoid, with interest at the rate of Six Percent (6%) per annum, of any and all said Twenty-six Hundred Dollar ($2,600.00) increases in said guaranteed minimum annual royalty theretofore paid Minneapolis by Mercoid, less any earned royalties in excess of the herein prescribed regular guaranteed minimum annual royalty; it being mutually understood and agreed that no part of the regular guaranteed minimum annual royalty provided by Section 8 hereof shall be so repaid at any time.

Notice in Advertisements, etc.

15. Mercoid agrees to select a particular designation and model or parts number and to apply such designation and number to each licensed Combustion Stoker Switch made and sold by it for use in said patented controls or systems and to use such designation and number in all references to such licensed switches in Mercoid's catalogs, and advertising literature printed after execution of this Agreement, and to accompany such designation and number by the following notice:

"Patent Notice: This control carries with it a license to use a system of preventing extinguishment of the fire when operating under low heat requirement conditions as covered by patents numbers 1,758,146 or 1,758,147 and or 1,969,136, as the case may be."

1099 Patent Marking.

16. Mercoid agrees to permanently and legibly mark each Combustion Stoker Switch made and sold after the execution of this Agreement with a notice as follows:

"Patent Notice: This control carries with it a license to use a system of preventing extinguishment of the fire when operating under low heat requirement conditions as covered by patents numbers 1,758,146 or 1,758,147 and/or 1,969,136, as the case may be."

Non-Estoppel.

17. Minneapolis agrees that Mercoid shall not be estopped, either during continuance of this Agreement or after termination thereof, to deny the validity of any claim or claims covering any device or apparatus which is not licensed hereunder, and which claim or claims is contained in said Jones patent, or shall be incorporated in any patent or patents granted pursuant to said Shipley applications.

Future Patents—Notices & Marking.

18. Mercoid agrees to add to the Notice and Marking prescribed by Sections 15 and 16 hereof, the number or numbers of any patents hereafter granted pursuant to said Shipley applications on literature printed or on products made after receipt of notice by Mercoid from Minneapolis of said new patent number or numbers.

Minneapolis' Right to Terminate For Breach, etc.

19. If the royalties herein provided shall at any time be in arrear for thirty (30) days after they shall become due, or if Mercoid shall become bankrupt or insolvent 1100 or enter into any settlement with the creditors, or shall make any default in performing any of the agreements herein contained, then, and in any such case, Minneapolis shall have the right by notice in writing mailed Mercoid, registered mail, postage prepaid, to its last known place of business, to revoke this license, which shall be-

come void the thirtieth (30th) day thereafter unless Mercoid shall have previously remedied such default or arrear without prejudice to any right of action or remedy of Minneapolis for the recovery of any moneys then due and accrued to the date of cancellation, to Minneapolis hereunder, or in respect of any antecedent breach of any agreement herein contained.

Sale of Additional Apparatus.

20. It is mutually understood and agreed that Mercoid has the right, so far as Minneapolis is concerned, to sell any and all apparatus, unaccompanied by a Combustion Stoker Switch, for use with a Combustion Stoker Switch which carries a license under any or all of the patents or applications embraced by this Agreement, to complete the systems covered by the claims of the particular patents or applications under which said Combustion Stoker Switch is licensed without incurring any liability, or paying any royalty, to Minneapolis under those particular patents or applications under which said Combustion Stoker Switch is licensed.

1101 Sales to Other Licensees.

21. It is mutually understood and agreed that Mercoid shall not be required to pay Minneapolis earned royalty for Combustion Stoker Switches sold to a party to whom a license is granted by Minneapolis under said Cross Patents Nos. 1,758,146 and 1,758,147.

Notices by the Parties.

22. It is mutually agreed that notices herein provided to be given by one party to the other shall be by registered mail, postage prepaid, return receipt demanded, addressed to the last known place of business of the addressee, and it is mutually agreed that, in the event either party shall desire to avail himself of any such notice, it will exhibit to the other party the post office receipt or the return receipt attesting the mailing of such notice.

Degree of Invalidity.

23. It is further mutually agreed that in the event any claim or claims of any of said Letters Patent or the patents to issue on said applications shall be held by a Court to be invalid or be so limited by a Court, or by agreement, or by disclaimer, or by reissue of any of said Letters Patent or patents to issue on said applications, as not to cover any particular system or apparatus embodying said Combustion Stoker Switch, then payment of the earned royalty by Mercoid to Minneapolis for the Combustion Stoker Switches embodied in such systems or ap- 1162 paratus thereby no longer covered or protected by one of said patents shall forthwith cease and terminate and be no longer required to be paid by Mercoid.

Cancellation—Disposal of Stock on Hand.

24. It is mutually agreed that in the event of cancellation of this Agreement Mercoid shall have the right to sell Combustion Stoker Switches which it may have on hand at the date of cancellation of this Agreement, provided Mercoid reports the number on hand and provided such switches are sold within four (4) months from the date of cancellation, and provided further that Mercoid pays to Minneapolis a royalty for each such switch then on hand at the rate provided in Paragraph 7 hereof, which payment shall be made at the time of termination of this Agreement.

Termination—Non Estoppel.

25. It is further mutually understood and agreed that in the event this Agreement and license shall be cancelled or terminated that Mercoid shall not thereafter be estopped, so far as Minneapolis is concerned, from any and all defenses against infringement, including the right to deny the validity of said Letters Patent, or the Letters Patent to issue on said applications, or any of them, in the same manner and to the same extent as though this license had never been held and enjoyed by Mercoid.

1103 Minneapolis' Covenant of Title and Authority.

26. Minneapolis hereby covenants and agrees to and with Mercoid, its successors and assigns, that at the time of the execution of this Agreement it, Minneapolis, has good right and lawful authority to make the within Agreement and license with respect to said Letters Patents, said applications, and the patents to issue thereon, and each of the same, and that it, Minneapolis, will not during the continuance of this Agreement do anything prejudicial to the rights of Mercoid hereunder.

Rights of Successors and Assigns.

27. This license shall inure to the benefit of and be binding upon the successors and assigns of Minneapolis, and to the benefit of and be binding upon the hereinbefore authorized successors and assigns of Mercoid.

Equality of Terms.

28. Minneapolis hereby covenants and agrees that in the event Minneapolis grants to another party a license similar in tenor and scope and having more favorable terms and including rights under all the patents and applications embraced by this Agreement, then and in such event, Minneapolis will and hereby does extend to Mercoid the same more favorable terms in this Agreement.

In Witness Whereof, Minneapolis and Mercoid have caused this Agreement to be signed by their respective
1104 duly authorized officers and their respective corporate seals to be duly affixed.

Minneapolis-Honeywell Regulator Company,

"Minneapolis"

By _____

The Mercoid Corporation,

"Mercoid"

By _____

State of Minnesota, }
County of Hennepin. } ss.

On this day of , 1935, before me appeared , to me personally known, who being by me duly sworn, did say that he is the of Minneapolis-Honeywell Regulator Company, that the seal affixed to the foregoing instrument is the corporate seal of said corporation, and that said instrument was executed in behalf of said corporation by authority of its board of directors; and said , acknowledged said instrument to be the free act and deed of said corporation.

In Witness Whereof, I have hereunto affixed my official signature with the seal of my office, the day and year above written.

*Notary Public, Hennepin County, Minnesota.*

My Commission Expires

State of Illinois, }
County of Cook. } ss.

On this day of , 1935, before me appeared , to me personally known, who, being by me duly sworn, did say that he is the of the Mercoid Corporation, and that the seal affixed to said instrument is the corporate seal of said corporation and that said instrument was signed and sealed in behalf of said corporation by authority of its board of directors, and said acknowledged said instrument to be the free act and deed of said corporation.

In Witness Whereof, I have hereunto affixed my official signature with the seal of my office, the day and year above written.

*Notary Public, Cook County, Illinois.*

My Commission Expires

TELEPHONE
MAIN 1328

MID-CONTINENT INVESTMENT COMPANY
700 BALTIMORE AVENUE
KANSAS CITY, MISSOURI

November 24, 1939

REGISTERED MAIL

The Mercoid Corporation
4201 Belmont Avenue
Chicago, Illinois

**Defendant's Exhibit R-R**

Gentlemen:

As you know, some time ago we brought a suit in the United States District Court, Southwestern Division of the Western District of Missouri, against F. O. Smith, at Carthage, Missouri, for an injunction and accounting, alleging that a dual thermostatic control installed in a domestic heating plant in his home constituted an infringement of our Patent No. 1758146.

Your Company, through Mr. Langdon Moore, a patent attorney, took charge of the preparation and presentation of the defense in this action, the installation in the Smith home being a Mercoid installation furnished and installed through one of your dealers.

In the pleadings filed in this case, the issue as to the validity of our patent was raised, and it was also claimed that the installation in the Smith home did not constitute an infringement of our patent. The trial court held that the patent was valid and infringed. The cause was appealed to the Eighth Circuit Court of Appeals, where the action of the trial court was affirmed.

Your Company was notified by us in the year 1938 that the sale and installation of the dual thermostatic controls for maintenance of a firebed in connection with a coal stoker, and as advertised in your circulars, constituted an infringement of our patent.

It now having been adjudicated that our patent is valid, and that you have infringed the same, before the institution of an action for damages we are writing to inquire as to whether you desire to discuss with us the question of the settlement of damages. If so, we shall be pleased to make an appointment at such time and place as may be agreed upon, where the matter may be fully discussed.

We shall delay the institution of an action for a reasonable period of time to give you an opportunity to reply to this letter.

Thanking you for the courtesy of a prompt reply, we are,

Very truly yours,

MID-CONTINENT INVESTMENT COMPANY,

By Forbes Dixon
President.

FC, vm

DEFENDANT'S EXHIBIT

MID-CONTINENT INVESTMENT COMPANY
700 BALTIMORE AVENUE
KANSAS CITY MISSOURI

February 5, 1940

Mr. H. Courteol
The Mercoid Corporation
4201 Belmont Avenue
Chicago, Illinois

Dear Mr. Courteol:

I have reported to the company on our conference of January 31. During the discussion, certain alternatives came up which I would like to place before you for consideration.

Two tentative plans of further compromise have been suggested. The first one would provide that the Mercoid Company pay $5000.00 to the Mid-Continent Company and in addition take a license under Patent 2,047,579, issued to the writer, and dated July 14, 1936. Such license would provide that the Mercoid Company would pay $1000.00 initially and that such payment would include the right of the Mercoid Company to investigate the possibilities of a commercial control for use under the teachings of the patent. One year's time would be allowed for the investigation and if at the end of that time, Mercoid did not desire to continue the agreement, it would be cancelled. However, if on the other hand, Mercoid should see sufficient merit in the application of the patent, the license agreement would continue at a reasonable minimum royalty which would apply against earned royalty. In this connection, I wish to point out that the patent is not limited to the use of the gas bulb or any one particular type of instrument in its application to the art. There are, of course, many forms of such an instrument which would be immediately obvious to you.

The second suggested tentative compromise would provide that the Mercoid Corporation pay the Mid-Continent Investment Company $5000.00 and in addition would acknowledge validity of Patent 2,047,579, above described, by means of a suitable instrument.

Another point which I believe germane to your consideration of our proposal is that the $4000.00 mentioned as our costs in the Smith case did not include any court costs and that such expenses amount to approximately another thousand dollars. We feel that these tentative plans for compromise

are as reasonable as could be expected of us and we wish to express our hope that we can arrive at a conclusion as suggested herein.

Kind personal regards,

MID-CONTINENT INVESTMENT COMPANY

By Walter M. Cross

Walter M. Cross, Jr.

WMC/vm

1108 DEFENDANT'S EXHIBIT.

August
First
1940

Mr. Richard Spencer
135 S. La Salle Street
Chicago, Illinois.

Re: License proposed by Mid-Continent

Dear Mr. Spencer:

Mr. Langdon Moore has submitted to us the proposed license you delivered to him on July 24, 1940, in behalf of Mid-Continent Investment Corporation, under the Cross patent No. 1,758,146.

As we understand it, this license is to be in full settlement of any and all past claims that Mid-Continent feels it has against Mercoid on account of the sale of Mercoid Controls which Mid-Continent allege infringed or contributed to the infringement of the Cross patent No. 1,758,146 and provides for future sales of such controls upon a royalty basis.

As stated to Mr. Cross, Mercoid denies it has infringed the Cross patent and that the sale of its controls does not contribute to the infringement of the Cross patent. Mercoid feels that the Mid-Continent alleged claims may have a nuisance value and therefore offered Mr. Cross a cash sum in settlement thereof.

After reading the proposed license, Mercoid considers that it does not need a license to practice the invention described and claimed in the Cross patent as Mercoid has never made installations and has no intention of making installations which would practice the Cross invention. Furthermore, all of the products, articles or controls made and sold by Mercoid for use in heating systems are made and sold by a license agreement under individual patents covering each of said products, articles or controls and therefore does not need an additional license to con-
1109 tinue its manufacture and sale of such products, articles or controls.

Upon further consideration of the proposed license it appears to Mercoid that this license is an attempt to expand the scope of the Cross patent to cover the use and

sale of products, articles or controls which are not covered by the Cross patent and are specifically covered by the patents of the Mercoid's licensor.

Mercoid therefore, does not care to accept the proposed license nor pay the sum of Five Thousand Dollars ($5,000.00) in settlement of the alleged claim of Mid-Continent against Mercoid.

Thanking you for your courtesy in this matter, we are

Yours very truly,

*President.*

H. Courteol G

(Stamp) Received Aug. 2, 1940. Langsdon Moore, Attorney at Law.

DEFENDANT'S EXHIBIT

SPENCER MARZALL JOHNSTON & COOK
ATTORNEYS AND COUNSELORS AT LAW
135 SOUTH LA SALLE STREET
CHICAGO

TELEPHONE CENTRAL 5080

WASHINGTON OFFICE
SUITE 820 NATIONAL PRESS BLDG
TELEPHONE NATIONAL 1845

August 1, 1940

Mr. Hugh Courteol
The Mercoid Corporation
4201 Belmont Avenue
Chicago, Illinois

My dear Mr. Courteol:

I have your letter of August 1, 1940 and upon reading it I do not see why in the world you ever asked me to prepare and submit to you a license agreement incorporating the terms of which you are well aware. Mr. Moore asked me to do this and I was careful not to include any provisions that could possibly be construed as adverse to your Company. However, your letter now indicates that you never had in mind the possibility of taking out a license and prefer to stand upon your past infringement of the Cross patent. Accordingly, we are preparing to file suit against you and will endeavor to collect royalties upon every control you have sold of a type which might possibly infringe the Cross patent, and will ask for triple damages and costs.

Under the circumstances I am at a complete loss to know why either you or Mr. Moore asked me to prepare and submit the license agreement which I went to the trouble of preparing. You will hear from us in due course and I venture to suggest that you will eventually be called upon to pay considerably more than the settlement that we offered.

Needless to say, the matter of infringement and validity is res adjudicata between your Company and our client, and the suit we will bring will not be one to find out whether or not you are entitled to practice the Cross process, but merely for an accounting to determine how much you owe Mid-Continent for having strenuously violated their patent in the past.

In closing, let me advise you that I am reporting on Monday morning to the Office of the Judge Advocate General of the Navy Department for two weeks of training duty, but upon my return to Chicago at the completion of that time your suit will be promptly filed.

Very truly yours,

Richard Spencer

RS:MD

cc: Mr. Langdon Moore
Dr. Roy Cross

1111 DEFENDANT'S EXHIBIT.

(Letterhead of Spencer, Marzall, Johnston & Cook, Chicago.)

August 27, 1940.

Mercoid Corporation
4219 Belmont Avenue
Chicago, Illinois

Re: Infringement of Cross Patent
No. 1,758,147

Gentlemen:

At the request of our client, the Mid-Continent Investment Company of Kansas City, Missouri, we hereby advise you that the Stokol Controls, in particular Control Type 115-W Immersatherm, which you are manufacturing and selling, are being used by dealers and others in direct infringement of United States Letters Patent 1,758,147 dated May 13, 1930 and granted to Walter M. Cross, which patent is now owned by our client, and that you are contributorily infringing said Letters Patent.

At the client's request, we request you to cease immediately such infringing acts and account to our client for damages occasioned by your past infringement. If you do not promptly comply with this request, we will be obliged to institute suit for an injunction and an accounting and this will be done at the convenience of our
1112 client and without further notice.

We would appreciate a response to this letter.

Very truly yours,
Spencer, Marzall, Johnston & Cook.

WSS:km
cc: Walter M. Cross
Registered Letter

113 DEFENDANT'S EXHIBIT.

September
Fourth
1940

Spencer, Marzall, Johnston & Cook
135 South La Salle Street
Chicago, Illinois

Re: Infringement Cross Patent
No. 1,758,147

Gentlemen:

Your letter of August 27, 1940, stating that your client, The Mid Continent Investment Company, considers the sale of the Mercoid Type 115 W Innersatherm contributes to the infringement of the above patent, has been carefully considered.

The said Cross patent refers to a particular type of mid operated thermostat 31 which is of an entirely different construction from our Innersatherm or Boiler Control. As the Mercoid Boiler Control has been on the market for many years prior to the filing date of the Cross patent, we fail to see how we are contributing to the infringement of this patent in the event that a purchaser of our control uses the instrument in a manner which you consider to be an infringement of this patent, and we, therefore, deny that we are contributorally infringing the said Cross patent No. 1,758,147.

Yours very truly,
The Mercoid Corporation,
Hugh Courteol,
*President.*

H. Courteol G

DEFENDANT'S EXHIBIT 55

**Defendant's Exhibit S-S**

THIS AGREEMENT, made this ____ day of _____, 1940, by and between MID-CONTINENT INVESTMENT COMPANY, a corporation organized and existing under the laws of the State of Missouri, with its principal place of business at 700 Baltimore Avenue, Kansas City, Missouri, (hereinafter referred to as Mid-Continent), and THE MERCOID CORPORATION, a corporation organized and existing under the laws of the State of Delaware, with its principal place of business at 4201 Belmont Avenue, Chicago, Illinois, (hereinafter referred to as Mercoid);

WITNESSETH, THAT:

WHEREAS, Mid-Continent is the owner of the entire right, title and interest in and to United States Letters Patent No. 1,758,146, granted May 13, 1930 to B. M. Cross; and

WHEREAS, Mercoid desires to obtain and Mid-Continent is willing to grant to Mercoid a non-exclusive, non-assignable license to manufacture, use, and/or sell products and devices for use in heating systems and plants of the type covered by the aforesaid United States Patent No. 1,758,146 throughout the United States of America, its territories and dependencies;

NOW, THEREFORE, for and in consideration of the sum of One Dollar ($1.00) paid by Mercoid to Mid-Continent, the receipt of which is hereby acknowledged, and in further consideration of and conditional upon the true and faithful performance by the parties hereto of all the undertakings and covenants hereinafter set forth to be kept and performed, it is hereby mutually agreed as follows:

License: Mid-Continent hereby grants to Mercoid a non-exclusive, non-assignable license under the said Patent No.

1,758,146, and reissues thereof, to practice throughout the United States of America, its territories and dependencies, the invention described and claimed in said patent, and any reissue thereof; to make, use and/or sell throughout the United States of America, its territories and dependencies, products or articles for use in heating systems or plants of the type described and claimed in said patent, and any reissues thereof. No right to sublicense is given.

Royalty: Mercoid agrees to pay Mid-Continent One Dollar ($1.00) as royalty for every stoker control sold by Mercoid and employed in such a way as to come within the terms of the patent herein licensed under.

Duration: The license granted herein shall extend for the full term of the said United States Patent No. 1,758,146, or any reissues thereof.

Past Infringement: Mercoid shall pay to Mid-Continent, on the date that this agreement is entered into, the sum of Five Thousand Dollars ($5000.00) as royalty for past infringement of the said United States Patent No. 1,758,146 prior to taking effect of this agreement, and Mercoid shall thereby be released from any and all liability for past infringement of said patent.

Access to Books: Mercoid shall keep a separate record of the articles or products manufactured and sold under the license herein granted, in sufficient detail to enable the royalties payable hereunder to be determined, and shall permit its books and records to be examined by Mid-Continent's authorized agent or officer from time to time during business hours, to the extent required to verify the record herein provided for.

Delinquency: Upon a failure of Mercoid to make royalty returns or to make royalty payments as heretofore specified and required, Mid-Continent will notify Mercoid of such omission, and Mercoid shall thereupon make the required payment within thirty (30) days of such notice.

Notices: Any notice or document required to be served hereunder by either party on the other may be served by enclosing the same in a postpaid wrapper, addressed to such other party at its last known address, and depositing the same by registered mail in any United States Post Office.

Arbitration: In case any controversy under this agreement shall arise between the parties to this agreement which they are unable to adjust between themselves, it shall be settled by arbitration in the following manner:

Either party may, by notice in writing served on the other, appoint one arbitrator and call upon the other to appoint a second arbitrator within thirty (30) days after the receipt of such notice; and each party agrees that, upon receiving any such notice, it shall so appoint an arbitrator. The two arbitrators shall, within thirty (30) days after the appointment of the one last appointed, jointly appoint a third arbitrator. The controversy shall be submitted to the three arbitrators in such manner as they shall direct and their decision, or the decision of a majority of them, rendered in writing shall be final, conclusive, and binding upon the parties. In the event that a second arbitrator shall not be appointed as above provided, or the two arbitrators first appointed shall fail to appoint a third, application may be made by either party to the United States

District Court for the Northern District of Illinois, Eastern Division, or to a judge thereof, to designate and appoint an arbitrator or arbitrators, as the case may require. Each party shall pay its own expenses in connection with the arbitration, but the compensation and expenses of the arbitrators shall be borne in such manner as may be specified in their decision in writing.

This written license contract embodies all of the understandings and agreements between the parties concerning the license herein granted, there being no other previous or contemporaneous understandings or agreements, oral or written, between the present parties on the foregoing subject.

IN WITNESS WHEREOF the parties hereto have caused these presents to be signed by their respective proper officers and their respective corporate seals to be hereunto affixed the day and year first above written.

MID-CONTINENT INVESTMENT COMPANY

By_____

Attest:

_____
Secretary

THE MERCOID CORPORATION

By_____

Attest:

_____
Secretary

MINNEAPOLIS-HONEYWELL REGULATOR CO.

EXECUTIVE OFFICES
MINNEAPOLIS MINNESOTA U.S.A.

FACTORIES MINNEAPOLIS, MINN.
PHILADELPHIA

**Defendant's Exhibit T-T .**

December 2, 1935.

F. Langdon Moore,
50 W. Jackson Blvd.
Chicago, Illinois.

DEC 1935

LANGDON MOORE
ATTORNEY AT LAW

Dear Langdon:-

In connection with your letter of November 29th, I am very sorry indeed that my absence from the city has gotten you into this jam. In connection with the cross matter which you are giving consideration to.

Our only thought in this matter is to give to Herold in this, in so far as we could, the same form of license that we gave the Detroit Lubricator Company, and my recollection was when I was talking this matter over with McCabe, that I explained to him the situation in reference to these additional patents, but evidently I was in error in this regard.

Basically both the Jones patent and the Shipley application have to do only with stoker controls, and the feature known as the "Outfire" control. You, of course, have or are obtaining copy of the Jones file. The Shipley patent has not as yet issued, and in fact, at the present time there are two applications pending on the Shipley file, one devoted to the switching mechanism and the other to the system. The Shipley patent has also run into some interferences, and we have been buying up the patents of the other parties, so that the whole situation in reference to the Shipley patent at the present time is rather a mess.

From our point of view, we cannot very well send you all of this material, but if you feel that it is of enough importance to you to come up here, our Patent Department will be glad to go over enough of this with you so that you can see the structure and the general situation and decide whether or not you want this Shipley application included in the license, or would prefer to have it out.

I am sending you herewith copy of original drawings, and original specifications, so you can get a clear idea of the structure covered.

Our situation works out about as follows: We have included in the license the Shipley patent with the thought that if eventually the broad claims went into some of the other patents which we have purchased, we would, of course, carry these claims over for the benefit of the licensee. At the same time until the applications are whipped into final shape, we do not know what the exact situation may

e, and there is structural detail and other matter included in some f the applications which the licensee may not be entitled to a license n.

I understand that Cross has extended the time of answer for n additional twenty days, so it will be necessary to urge rather quick ecisions on this, and I would like to hear from you as to how you ant to proceed as soon as convenient after receipt of this letter.

H

Yours very truly,

Howard W Sweatt

. . Sweatt
T

P.S. I have just been informed that Mr. Fisher of our Patent Department will be in Chicago Thursday and if you wish to have him bring some of this material with him and go over it Thursday afternoon, I will see that he takes it. Please wire me tomorrow if you expect to be in town and will have time to see Mr. Fisher Thursday afternoon.

H.W.S.

1120 DEFENDANT'S EXHIBIT VV.

Sub-License Agreement.

Agreement made this 19 day of July, 1933, by and between Minneapolis-Honeywell Regulator Company, a corporation organized and existing under the laws of the State of Delaware and having a principal place of business at 2727 Fourth Avenue South, Minneapolis, Hennepin County, Minnesota, hereinafter called "Minneapolis", and Detroit Lubricator Company, a corporation organized and existing under the laws of the State of Michigan, and having a principal place of business at 5842 Trumbull Avenue, Detroit, Wayne County, Michigan, hereinafter called "Detroit", Witnesseth:

Whereas, Minneapolis is the present owner of the sole and exclusive right and license to make, use and sell and to sub license others to make, use and sell the inventions disclosed in the following two Letters Patent of the United States as applied to coal Stokers:

| Number | Inventor | Granted | Invention |
|---|---|---|---|
| 1,758,146 | Walter M. Cross | May 13, 1930 | Domestic Heating System |
| 1,758,147 | Walter M. Cross | May 13, 1930 | Heating System Control |

Whereas, Minneapolis acquired such exclusive license with right to grant sub-licenses pursuant to a license agreement entered into by it as sub licensee on December 23, 1931, with Cross Coal-O-Matic Company and one Butler Manufacturing Company as Licensors, the former being the owner of the entire right, title and interest in and to said inventions and said patents, subject to an exclusive license to the latter now extinguished:

1121 Whereas, said Cross-Butler-Minneapolis Agreement of December 23rd, 1931, has been modified in part by two subsequent agreements contained in letters dated January 21st, 1933 and June 5th, 1933, the first of which extends the time for making statements and paying royalty fees by Minneapolis as provided in paragraph six (6) therein from the 15th days of January, April, July and October of each year to the 25th days of January, April, July and October of each year and the second of which

modifies paragraph sixteen (16) thereof by striking out the words "become bankrupt or insolvent or enter into any settlement with its creditors, or shall" in lines three (3) and four (4) of said paragraph sixteen (16), whereby Cross and Butler no longer have the right to cancel said Cross-Butler-Minneapolis Agreement in the event Minneapolis should become bankrupt or insolvent or enter into any settlement with its creditors;

Whereas, Minneapolis has the right to terminate said prior license agreement on any anniversary date thereof and has agreed therein that any sub-licenses granted thereunder shall be terminated coincidentally with its license;

Whereas, Minneapolis is the present owner of the entire right, title and interest in and to be patent application filed by one David J. Jones in the United States Patent Office on July 18, 1930, bearing Serial Number 468,889 for Control Systems for Stoker Motors, and the invention therein contained; subject only to an outstanding prior non-exclusive license;

1122 Whereas, Minneapolis, by virtue of a certain agreement between Minneapolis and Penn Electric Switch Company, a corporation of Iowa and having a principal place of business at Des Moines, Polk County, Iowa, has the right to grant a non-exclusive sub-license to make, use and sell Heating Furnace Controls disclosed in United States Patent No. 1,882,341, granted October 11, 1932, filed by Russell W. Stem on September 6, 1930, the entire right, title and interest in and to said Stem invention and patent being owned by Penn Electric Switch Company, subject only to certain rights of Minneapolis;

Whereas, Minneapolis is the owner of the entire right, title and interest in and to a pending patent application filed by one Sylvanus C. Shipley in the United States Patent Office on April 30, 1932, bearing Serial No. 606,440, for improvements in Control Systems for Automatic Stokers, and the invention therein contained;

Whereas, Detroit is desirous of securing a non-exclusive license and sub-license under said patents and applications and Minneapolis is willing to grant such license and sub-license;

Now, Therefore, in consideration of One Dollar ($1.00) in cash, each to the other in hand paid, the receipts whereof are jointly and severally acknowledged, and in consideration of the mutual representations, covenants and agree-

ments herein set out, Minneapolis and Detroit mutually and severally represent, covenant and agree as follows:

1123 Definitions.

1. That the term "Combustion Stoker Switch" is now known to both parties hereto and is a device, including an automatic electric-switching means responsive directly to temperatures of combustion gases or boiler water produced by an automatic coal-fuel stoker and adapted, in combination with other devices and apparatus, for the control of automatically operated coal fuel stokers, and having at least the function of preventing the extinguishment of its fire when operating under low heat requirement conditions and which switching means is peculiarly adapted for use in the Heating Systems and Controls forming the subject-matter of said three patents and said two pending applications and such term Combustion Stoker Switch as herein used is only applicable to such device when it bears the license-conferring notice recited in Section 16 hereof.

2. That the term "net sales price" for the purposes of this Agreement and as used herein, shall be that sum or amount of money, less all pecuniary discounts and allowances, which is chargeable to, and to be paid by, a buyer for each Combustion Stoker Switch.

Grant.

3. Minneapolis hereby grants Detroit a non-exclusive license to make and have made for it and to use and to sell said above described "Combustion Stoker Switches" and to use and to sell and any all apparatus, in whole or in part, in combination with such a Combustion Stoker Switch, for use in, or to constitute embodiments of, the inventions
1124 covered by said Letters Patent or any of them or said applications or either of them and the patents to be granted thereon; Provided, however, such non-exclusive license to make, use and sell the Combustion Stoker Switch shown and described in said Shipley application is restricted to the manufacture, use and sale of said Shipley Combustion Stoker Switch for use only in the systems and system controls shown and described in said patents and applications; and, Provided further, that only those systems or system controls shall be licensed hereunder for

which Detroit shall pay to Minneapolis the hereinafter prescribed royalties due and payable hereunder for each Combustion Stoker Switch used in each such licensed system or system control; and, Provided further, that no license under any patents or applications or inventions other than those herein recited is hereby granted or implied, except as shall be necessary and essential to the enjoyment of this license by Detroit.

Duration.

4. The license and sub-license hereby granted Detroit by Minneapolis shall continue until the expiration of said patents or of that of the patent last granted upon said applications, whichever shall be the longer, and of any reissues thereof, unless this license and sub-license is earlier terminated in accordance with the provisions hereof.

Territory.

5. The license and sub-license hereby granted shall extend throughout the territory of the United States of America and its possessions, and, so far as concerns the license hereby granted under said Jones and Shipley 1125 applications, they shall additionally extend throughout the territory of the Dominion of Canada.

Assignability.

6. Unless earlier terminated in accordance with the provisions of this Agreement, the license and the sub-license hereby granted shall only be assignable by Detroit in connection with the sale of all or a major portion of Detroit's entire assets and good will or, in connection with its reorganization or consolidation or merger with another corporation.

Earned Royalty.

7. Detroit agrees to pay Minneapolis as a minimum earned royalty for each licensed "Combustion Stoker Switch", responsive directly to temperatures of combustion gases and adapted to cooperate with other devices or apparatus to prevent extinguishment of the fire of an automatic coal fuel stoker, sold by or for it, pursuant to the

provisions of this Agreement, the sum of One Dollar Twenty Five Cents ($1.25), and, in the event Five Percent (5%) of Detroit's net sales prices of said "Combustion Stoker Switch" shall exceed One Dollar Twenty Five Cents ($1.25), then, and in each such event, the earned royalty for each such switch shall be Five Percent (5%) of such net sales price; and provided further, that the minimum earned royalty for each such licensed switch which is adapted to be responsive to boiler water temperature and is not adapted to be responsive to combustion gases shall be fixed at One Dollar ($1.00) and in the event Five
1126 Percent (5%) of Detroit's net sales price of such boiler-water responsive switch shall exceed One Dollar ($1.00) then, and in each such event, the earned royalty therefor shall be Five Percent (5%) of such net sales price.

Minimum Annual Royalties.

8. Detroit agrees to pay during the existence of this sub-license, a minimum guaranteed royalty of Five Hundred Dollars ($500.00) for the period beginning with the execution of this Agreement and ending December 31, 1933, and a minimum guaranteed royalty of Seven Hundred Fifty Dollars ($750.00) for the calendar year 1934; and a minimum guaranteed royalty of Twelve Hundred Fifty Dollars ($1250.00) for the calendar year 1935 and a minimum guaranteed royalty of Twenty Five Hundred Dollars ($2500.00) for the calendar year 1936 and each calendar year thereafter; each of said minimum guaranteed annual royalties shall be paid in equal half-yearly payments in advance on January 20, and July 20 of each year; provided that, in the event of termination of this Agreement as herein provided, said minimum annual royalty payment for the then-current year shall be pro-rated and such pro-rated part for the expired portion of the then-current year shall constitute the limit of liability of Detroit for minimum annual royalty for such year.

Statements and Payments.

9. Detroit agrees to pay the earned royalties due hereunder to Minneapolis and to make quarterly statements to Minneapolis on the twentieth (20th) days of January,
1127 April, July and October of each year during the existence of this Agreement, showing all sales made of

said switches and net prices thereof for the quarterly period ending with the last day of the month preceding each such statement, and Detroit agrees to accompany each such statement with the earned royalties thereby shown to be due, less any payment of minimum guaranteed royalties theretofore, or then to be, made during the calendar year in which such statement was rendered.

Examination of Records.

10. Detroit agrees to keep accurate books of account concerning sales, net prices and transactions pertaining to said Combustion Stoker Switches and agrees that Minneapolis shall be permitted, through certified public accountants, to examine such books of account at reasonable times, it being understood that such examinations shall be limited to sales, prices and transactions of said Combustion Stoker Switches.

Exception to Report of Prices.

11. It is mutually agreed that, so long as the net selling price of Combustion Stoker Switches responsive either to the temperature of the combustion gases or the temperature of the boiler water is less than Fifteen Dollars ($15.00) per device, Detroit shall be relieved of the obligation to report the net sales prices of each such switch in rendering quarterly reports provided for in Section 9 hereof.

1128

Definition of "Sold".

12. It is jointly and severally agreed that, for the purposes of this Agreement, said switches shall be considered to be sold when billed out, or if not billed out, then when delivered, or when paid for, if paid for before delivery, and it is further so agreed that royalties paid on switches which are lost or damaged in transit or otherwise defective or returned for credit, and not accepted by the customers, may be deducted from further royalty payments to be made hereunder.

Termination by Detroit.

13. Detroit shall have the right to terminate this Agreement on December 31st of any year during its continuance by previous notice thereof in writing, sent registered mail;

postage prepaid, to Minneapolis at its last known place of business, not later than the first day of October next preceding whereupon this license shall cease and all rights and liabilities of Detroit shall terminate without prejudice to any rights of Minneapolis to recover any moneys then due by way of royalties prior to such termination.

Termination by Minneapolis.

14. Minneapolis shall have the right to terminate this Agreement on December thirty-first (31st) of any year during its continuance by previous notice thereof in writing, sent registered mail, postage prepaid, to Detroit at its last known place of business, not later than the fifteenth (15th) day of September next preceding, whereupon
1129 this Agreement shall cease and all rights and liabilities of Detroit thereunder shall terminate without prejudice to any rights of Minneapolis to recover any moneys then due by way of royalties prior to such termination; provided, however, the herein recited right of Minneapolis so to terminate this Agreement is, and shall be, subject to the following limitation and qualification, to wit, in the event that Minneapolis shall in any year during the continuance of this Agreement have duly notified Detroit of Minneapolis' election to terminate this Agreement and Detroit shall desire the continuance of this Agreement, then, Detroit shall have the right to continue this Agreement in full force and effect by written notice to Minneapolis sent registered mail, postage prepaid, not later than the thirtieth (30th) day after mailing of Minneapolis' such notice, to Minneapolis' last known place of business of such election to continue, whereupon Minneapolis agrees not to terminate said Agreement and not to manufacture or sell said Combustion Stoker Switches for embodiment in the system or systems disclosed in said Cross Patents 1,758,146 and 1,758,147, or either of them, and the rights, obligations, liabilities and other provisions of this Agreement shall continue in full force and effect with the single exception that each guaranteed minimum annual royalty to be paid by Detroit to Minneapolis for the next and each succeeding year thereafter shall be increased by One Thousand Dollars ($1,000.00); Provided, further, however, in the events that this Agreement shall have been continued and Minneapolis shall have ceased manufacture or sale of said Combustion

Stoker Switches and Detroit shall have paid said in-
1130 creased guaranteed minimum annual royalty as here-
in specified, and thereafter Minneapolis shall desire to resume such manufacture and sale, then Minneapolis shall have the right so to resume upon written notice to Detroit and upon re payment to Detroit, with interest at the rate of Six Percent (6%) per annum, of any and all said One Thousand Dollar ($1,000.00) increases in said guaranteed minimum annual royalty and theretofore paid Minneapolis by Detroit, less any carried royalties in excess of the herein prescribed regular guaranteed minimum annual royalty; it being mutually understood and agreed that no part of the regular guaranteed minimum annual royalty provided by Section 8 hereof shall be so repaid at any time.

Notice in Advertisements, Etc.

15. Detroit agrees to select a particular designation and model or parts number and to apply such designation and number to each licensed Combustion Stoker Switch made and sold by it for use in said patented controls or systems and to use such designation and number in all references to such licensed switches in Detroit's catalogs, and advertising literature printed after execution of this Agreement, and to accompany such designation and number by the following notice:

"Patent Notice: This control carries with it a license to use a system of preventing extinguishment of the fire when operating under low heat requirement conditions as covered by patents numbers 1,758,146 or 1,758,147 and or 1,882,341, as the case may be."

1131 Patent Marking.

16. Detroit agrees to permanently and legibly mark each Combustion Stoker Switch made and sold after the execution of this Agreement with a notice as follows:

"Pat ait Notice: This control carries with it a license to use a system of preventing extinguishment of the fire when operating under low heat requirement conditions as covered by patents numbers 1,758,146 or 1,758,147 and or 1,882,341, as the case may be."

Non-Estoppel.

17. Minneapolis agrees that Detroit shall not be estopped, either during continuance of this Agreement or after termination thereof, to deny the validity of any claim or claims covering any device or apparatus which is not licensed hereunder, and which claim or claims shall be incorporated in any patent or patents granted pursuant to said Jones and said Shipley applications.

Future Patents—Notice & Marking.

18. Detroit agrees to add to the Notice and Marking prescribed by Sections 15 and 16 hereof, the number or numbers of any patents hereafter granted pursuant to said Jones and Shipley applications on literature printed or on products made after receipt of notice by Detroit from Minneapolis of said new patent number or numbers.

Minneapolis' Right to Terminate for Breach, Etc.

19. If the royalties herein provided shall at any time be in arrear for thirty (30) days after they shall become due, or if Detroit shall become bankrupt or insolvent 1132 or enter into any settlement with its creditors, or shall make any default in performing any of the agreements herein contained, then, and in any such case, Minneapolis shall have the right by notice in writing mailed Detroit, registered mail, postage prepaid, to its last known place of business, to revoke this license, which shall become void the thirtieth (30th) day thereafter unless Detroit shall have previously remedied such default or arrear, without prejudice to any right of action or remedy of Minneapolis for the recovery of any moneys then due and accrued to the date of cancellation, to Minneapolis hereunder, or in respect of any antecedent breach of any agreement herein contained.

Sale of Additional Apparatus.

20. It is mutually understood and agreed that Detroit has the right, so far as Minneapolis is concerned, to sell any and all apparatus, unaccompanied by a Combustion

Stoker Switch, for use with a Combustion Stoker Switch which carries a license under any or all of the patents or applications embraced by this Agreement, to complete the systems covered by the claims of the particular patents or applications under which said Combustion Stoker Switch is licensed without incurring any liability, or paying any royalty, to Minneapolis under those particular patents or applications under which said Combustion Stoker Switch is licensed.

1133 Sales To Other Licensees.

21. It is mutually understood and agreed that Detroit shall not be required to pay Minneapolis earned royalty for Combustion Stoker Switches sold to a party to whom a license is granted by Minneapolis under said Cross Patents Nos. 1,758,146 and 1,758,147.

Notices By the Parties.

22. It is mutually agreed that notices herein provided to be given by one party to the other shall be by registered mail, postage prepaid, return receipt demanded, addressed to the last known place of business of the addressee, and it is mutually agreed that, in the event either party shall desire to avail itself of any such notice, it will exhibit to the other party the post office receipt or the return receipt attesting the mailing of such notice.

Decree of Invalidity.

23. It is further mutually agreed that in the event any claims of any of said Letters Patent or the patents to issue on said applications shall be held by a Court to be invalid or be so limited by a Court, or by agreement, or by disclaimer, or by reissue of any of said Letters Patent or patents to issue on said applications, as not to cover any particular system or apparatus embodying said Combustion Stoker Switch, then payment of the earned royalty by Detroit to Minneapolis for the Combustion Stoker Switches embodied in such systems or apparatus
1134 thereby no longer covered or protected by one of said patents shall forthwith cease and terminate and be no longer required to be paid by Detroit.

Cancellation—Disposal of Stock on Hand.

24. It is mutually agreed that in the event of cancellation of this Agreement Detroit shall have the right to sell Combustion Stoker Switches which it may have on hand at the date of cancellation of this Agreement, provided Detroit reports the number on hand and provided such switches are sold within four (4) months from the date of cancellation, and provided further that Detroit pays to Minneapolis a royalty for each such switch then on hand at the rate provided in Paragraph 7 hereof, which payment shall be made at the time of termination of this Agreement.

Termination—Non-Estoppel.

25. It is further mutually understood and agreed that in the event this Agreement and license shall be cancelled or terminated that Detroit shall not thereafter be estopped, so far as Minneapolis is concerned, from any and all defenses against infringement, including the right to deny the validity of said Letters Patent; or the Letters Patent to issue on said applications, or any of them, in the same manner and to the same extent as though this license had never been held and enjoyed by Detroit.

1135 Minneapolis' Covenant of Title and Authority.

26. Minneapolis hereby covenants and agrees to and with Detroit, its successors and assigns, that at the time of the execution of this Agreement it, Minneapolis, has good right and lawful authority to make the within Agreement and license with respect to said Letters Patents, said applications, and the patents to issue thereon, and each of the same, and that it, Minneapolis, will not during the continuance of this Agreement do anything prejudicial to the rights of Detroit hereunder.

Rights of Successors and Assigns.

27. This license shall inure to the benefit of and be binding upon the successors and assigns of Minneapolis, and to the benefit of and be binding upon the hereinbefore authorized successors and assigns of Detroit.

Equality of Terms.

28. Minneapolis hereby covenants and agrees that in the event Minneapolis grants to another party a license similar in tenor and scope and having more favorable terms and including rights under all the patents and applications embraced by this Agreement, then and in such event, Minneapolis will and hereby does extend to Detroit the same more favorable terms in this Agreement.

In Witness Whereof, Minneapolis and Detroit have caused this Agreement to be signed by their respective
1136 duly authorized officers and their respective corporate seals to be duly affixed.

Minneapolis-Honeywell Regulator Company,
"Minneapolis,"
By H. W. Sweatt,
Seal *Vice Pres.*

Detroit Lubricator Company,
"Detroit,"
By F. W. Hodges,
*Pres.*

State of Minnesota, }
County of Hennepin. } ss.

On this 24 day of July, 1933, before me appeared H. W. Sweatt, to me personally known, who, being by me duly sworn, did say that he is the Vice Pres. of Minneapolis-Honeywell Regulator Company, that the seal affixed to the foregoing instrument is the corporate seal of said corporation, and that said instrument was executed in behalf of said corporation by authority of its board of directors; and said H. W. Sweatt, acknowledged said instrument to be the free act and deed of said corporation.

In Witness Whereof, I have hereunto affixed my official signature with the seal of my office, the day and year above written.

(Seal) J. Vandergon,
*Notary Public, Hennepin County, Minnesota.*

My Commission Expires 2.14.46.

State of Michigan, } ss.
County of Wayne. }

On this 19 day of July, 1933, before me appeared F. W. Hodges, to me personally known, who, being by me duly sworn, did say that he is the Pres. of Detroit Lubricator Company, and that the seal affixed to said instrument is the corporate seal of said corporation and that said instrument was signed and sealed in behalf of said corporation by authority of its board of directors, and said F. W. Hodges acknowledged said instrument to be the free act and deed of said corporation.

In Witness Whereof, I have hereunto affixed my official signature with the seal of my office, the day and year above written.

Doris M. Panton,
(Seal) *Notary Public, Wayne County, Mich.*

My Commission expires 8-28-33.

1137 DEFENDANT'S EXHIBIT WW.

Agreement.

Agreement made this 23rd day of January, 1932, by and between Minneapolis-Honeywell Regulator Company, a corporation of Delaware and having a principal place of business in Minneapolis, Hennepin County, Minnesota, hereinafter called "Minneapolis" and Penn Electric Switch Company, a corporation organized and existing under the laws of the State of Iowa, and having a principal place of business at Des Moines, Polk County, Iowa, hereinafter called "Penn"; Witnesseth:

Whereas, Minneapolis is the present owner of the entire right, title and interest in and to a patent application filed by David J. Jones in the United States Patent Office on July 18, 1930, bearing Serial No. 468,889, for Control Systems for Stoker Motors, and the invention disclosed therein, and Penn owns the entire right, title and interest in and to a patent application filed by Russell W. Stem in the United States Patent Office on September 6, 1930,

bearing Serial No. 480,045, for Heating Furnace Control, and the invention disclosed therein, subject only to the reserved right of said Stem to make, use and sell the Heating Furnace Control disclosed in said Stem application, which reserved right is assignable by Stem only to a corporation in which said Stem shall own the controlling interest;

Whereas, Interference No. 61,433 has been declared by the United States Patent Office between said Jones and Stem applications involving six counts; and

Whereas, said applicants and their assignees are mutually desirous of settling said interference;

Now, Therefore, it is mutually covenanted and agreed by and between Minneapolis and Penn, the covenants and agreements of the one being the consideration for the covenants and agreements of the other as follows:

1. Minneapolis agrees to secure from its assignor, Jones, a formal recordable concession of priority in favor of Penn's assignor Stem, of Counts 1, 3, 4, 5 and 6.

2. Penn agrees to secure from its assignor, Stem, a formal recordable concession of priority in favor of Minneapolis' assignor, Jones, of Count 2.

3. Minneapolis and Penn mutually agree to exchange said Jones and Stem concession of Priority, duly assigned to in writing by the appropriate assignee on or before Saturday, January 23, 1932.

4. Minneapolis hereby grants Penn a non-exclusive license, free of royalty payments to make, use and sell apparatus shown, described and claimed in said Jones application and in any patent or patents granted pursuant to said application or any divisions or continuances in whole or part thereof, for the life of each and every patent or patents.

5. Minneapolis grants Penn the right to grant one sub-license to one other person, firm, or corporation, make, use and sell, apparatus shown, described and claimed in said Jones application and any patent or patents granted pursuant to said application or any divisions or continuations in whole or in part thereof for the life of each and every such patent or patents; provided, however, that said sub-license shall be void and of no effect unless Penn shall notify Minneapolis in writing of the grant of such a sub-

license within ten (10) days after the execution of such sub-license.

6. Penn hereby grants Minneapolis a non-exclusive license, free of royalty payments, to make, use and sell apparatus shown, described and claimed in said Stem application and in any patent or patents granted pursuant to said application or any divisions or continuances in whole or part thereof, for the life of each and every such patent or patents.

1139 7. Penn grants Minneapolis the right to grant one sub-license to one other person, firm or corporation to make, use and sell, apparatus shown, described and claimed in said Stem application and any patent or patents granted pursuant to said application or any divisions or continuations in whole or in part thereof for the life of each and every such patent of patents; provided, however, that said sub-license shall be void and of no effect unless Minneapolis shall notify Penn in writing of the grant of such a sub-license within ten (10) days after the execution of such sub-license.

8. Minneapolis and Penn each agrees to execute at the request of the other any further papers, documents or instruments necessary to carry out the purpose, intent and agreements herein recited.

9. The licenses and rights herein granted may only be assigned or transferred by the parties hereto, to their successors, or, by assignment made as a part of the sale of all or a major portion of such assignor's entire assets and good will or in connection with a merger, consolidation or reorganizatin.

10. It is mutually agreed that, in the event that any sub-license granted by either Minneapolis or Penn as Licensor shall be terminated, then, such Licensor shall have the right to grant another sub-license in place thereof and subject to the terms of this agreement as to notice thereof, it being merely mutually understood and agreed that neither Minneapolis nor Penn shall have more than one outstanding sub-license hereunder at any one time.

11. If is further mutually agreed that each sub-license granted pursuant to Section Five (5) or Section Seven (7) hereof shall only be assignable by such sub-licensee in connection with the sale of all or a major portion of 1140 such sub-licensee's entire assets and good will or in

connection with a merger, consolidation, or reorganization of such sub-licensee.

Witness our hands and seals.

Minneapolis Honeywell Regulator Company
"Minneapolis"

(Corporate Seal)

By Julius K. Luthe (sgd.)
*Vice-Pres.*

Penn Electric Switch Company
"Penn"

(Corporate Seal)

By Albert Penn (sgd.)

State of Minnesota, } ss.
County of Hennepin. }

On this 26th day of January, 1932, before me, Julius K. Luthe, to me personally known, who, being by me duly sworn, did say that he is the Vice-President of Minneapolis-Honeywell Regulator Company; that the seal affixed to the foregoing instrument is the corporate seal of said corporation, and that said instrument was executed in behalf of said corporation by authority of its board of directors; and said Julius K. Luthe acknowledged said instrument to be the free act and deed of said corporation.

J. Vandergon (Sgd.)
(Seal) *Notary Public, Hennepin County, Minnesota.*

My commission expired Feb. 15, 1933.

1141 State of Iowa, } ss.
County of Polk. }

On this 23rd day of January, 1932, before me appeared Albert Penn, to me personally known, who, being by me duly sworn, did say that he is the President of Penn Electric Switch Company, and that the seal affixed to said instrument is the corporate seal of said corporation, and that said instrument was signed and sealed in behalf of said corporation by authority of its Board of Directors, and said Albert Penn acknowledged said instrument to be the voluntary act and deed of said corporation.

Dorothy L. Cope (Sgd.)
*Notary Public, Polk County, Iowa.*

My commission expires July 4, 1933.

1142 State of Illinois, }
County of Cook. } ss.

James F. Chambliss being duly sworn deposes and says that he is the Secretary and Assistant Treasurer of The Mercoid Corporation; that the following table sets forth the number of Mercoid Fire Maintaining Controls sold during each year of the years indicated on the following table, as taken from the records of The Mercoid Corporation:

| Year | Temperature Responsive | Timer Controls | Total |
|---|---|---|---|
| 1931 | 595 | 0 | 595 |
| 1932 | 1,003 | 0 | 1,003 |
| 1933 | 1,721 | 0 | 1,721 |
| 1934 | 2,495 | 80 | 2,495 |
| 1935 | 2,325 | 248 | 2,573 |
| 1936 | 1,649 | 2,782 | 4,431 |
| 1937 | 723 | 6,651 | 7,374 |
| 1938 | 150 | 6,019 | 6,169 |
| 1939 | 0 | 6,473 | 6,473 |
| 1940 | 0 | 7,345 | 7,345 |

James F. Chambliss.

Subscribed and sworn to before me this Sixteenth day of September, 1941.

Mildred J. Bergerson,
(Seal) *Notary Public.*
My Commission Expires December 2, 1942.

1144 And afterwards, to wit, on the 6th day of January, A. D. 1942, being one of the days of the regular December term of said Court, in the record of proceedings thereof, in said entitled cause, before the Honorable Michael L. Igoe, District Judge, appears the following entry, to wit:

Filed D. C. 1942.

1145 IN THE DISTRICT COURT OF THE UNITED STATES.

(Caption 2070).

## FINDINGS OF FACT, CONCLUSIONS OF LAW AND FINAL DECREE.

Spencer, Marzell, Johnston & Cook,
*Attorneys for Mid-Continent Investment Company.*

Wilfred S. Stone,
*Of Counsel.*

Bair & Freeman,
*Attorneys for Minneapolis-Honeywell Regulator Company.*

Langdon Moore,
L. Kerans Moore,
*Attorneys for The Mercoid Corporation.*

1146 IN THE DISTRICT COURT OF THE UNITED STATES.

(Caption—2070)

### Findings of Fact.

1. Plaintiff Mid-Continent Investment Company is a corporation of Missouri; plaintiff Minneapolis-Honeywell Regulator Company is a corporation of Delaware, licensed to do business in the State of Illinois, with a registered agent in Chicago, Illinois.

2. Defendant, The Mercoid Corporation, is a corporation of Delaware with a regular and established place of business in Chicago, Illinois.

1147 3. Plaintiff Mid-Continent Investment Company brought this suit against the defendant on September 10, 1940, charging contributory infringement of its patent No. 1,758,146, granted Walter M. Cross, May 13, 1930, for a Domestic Heating System, by making and selling combustion responsive low limit controls or switches that may be used in said domestic heating system for the purpose of preventing the fire in the furnace from going out.

4. Plaintiff Mid-Continent Investment Company mailed to the defendant a formal notice of infringement of the

patent in suit on November 24, 1932, alleging the accused device in the suit at bar was an infringement of the Cross patents Nos. 1,758,146 and 1,758,147.

5. Plaintiff Mid-Continent Investment Company, during August 1935, brought suit against E. O. Smith of Carthage, Missouri, for infringement of the domestic heating system patent of Cross No. 1,758,146 by installing in his home a heating system including controls manufactured by the defendant.

The Court found the patent valid and that the heating system installed in the residence of Smith infringed the heating system patent of Cross. The Mercoid Corporation provided the defense of Smith but was not made a party to the suit nor was the manufacture and sale of the Mercoid M-61 an issue in this suit.

6. The Cross patent No. 1,758,146 is for a method or system for preventing the fire in an automatic coal stoker furnace from going out during long periods of mild weather by inserting in the automatic control system a low limit switch responsive to combustion conditions within the furnace to operate the stoker whenever a predetermined low temperature within the furnace is reached. It is admitted that Cross did not invent the low limit switch, also called a combustion stoker switch. The com-
1148 bustion stoker switch illustrated in the Cross patent is of the same appearance, construction and operation as the defendant's Mercoid Figure 37 temperature responsive limit switch patented by defendant and on the market prior to 1925. Defendant placed on the market at the same time the Mercoid Figure 50 temperature responsive limit switch made under the same patent. The Mercoid Figure 50 was modified as to construction but identical in function and operation and was placed on the market in 1929 as the Mercoid M-51 temperature responsive furnace control. This modification was also patented. The Mercoid M-61 temperature responsive limit switch, the accused device, was made under the same patent as the M-51 and is identical in function, operation and use and in addition is capable of use as a combustion stoker switch when installed in a heating system. The Mercoid TJV and JMV controls, also accused devices, do not operate at a predetermined low temperature.

7. Plaintiff Mid-Continent Investment Company has never made and has never installed heating systems in accordance with the Cross patent No. 1,758,146.

8. Plaintiff, Minneapolis-Honeywell Regulator Company upon motion by defendant was made a party plaintiff by order of this Court as the exclusive licensee of the Cross patents Nos. 1,758,146 and 1,758,147.

9. Plaintiff Minneapolis-Honeywell Regulator Company does not make or install heating systems.

10. Defendant The Mercoid Corporation has never made or installed heating systems.

11. Cross Coal-O-Matic Company, predecessor in title of plaintiff Mid-Continent Investment Company, did, during the years 1928, 1929, and 1930, engage in the business of installing heating systems including stokers, and controls therefor bought from both defendant and the 1149 unwilling plaintiff Minneapolis-Honeywell Regulator Company.

There is no proof that Cross Coal-O-Matic Company ever practiced the invention of the Cross patent prior to the grant thereof in 1930.

There is proof that Minneapolis-Honeywell Regulator Company developed its combustion stoker switch independently of the Cross patent and had it on the market prior to the grant thereof.

12. Plaintiff Mid-Continent Investment Company succeeded to the title of the Cross patent No. 1,758,146 on June 2, 1932. Its predecessor in title, Cross Coal-O-Matic Company, on December 23, 1931, granted Minneapolis-Honeywell Regulator Company an exclusive license to make, use and sell and to sublicense others to make, use and sell the inventions described in the Cross patents Nos. 1,758,146 and 1,758,147, as applied to coal stokers, in which it was agreed that the royalty payments to be made thereunder shall be made or based only upon what are known to the parties as a combustion stoker switch, specifically defined as a combustion stoker control unit including an automatic electric switch responsive directly to temperatures of combustion gases or boiler water produced by an automatic coal fed stoker. Minneapolis-Honeywell Regulator Company agreed to pay a royalty for each licensed combustion stoker switch made and sold by it and by its sub-licensees.

13. Minneapolis-Honeywell Regulator Company exercised its right under its exclusive license and granted a sub-license to Detroit Lubricator Company on July 19, 1933, to make and have made for it and to use and sell combustion stoker switches and to use and sell any and

all apparatus in combination with such a combustion stoker switch for use in, or to constitute an embodi-
1150 ment of the invention covered by said patent No. 1,758,146; to pay Minneapolis-Honeywell Regulator Company a royalty for each licensed combustion stoker switch sold by it and to mark each combustion stoker switch made and sold by it under said sub-license with the Patent Notice:

"This control carries with it a license to use a system of preventing extinguishment of the fire when operating under low heat requirement conditions as covered by patents Nos. 1,758,146 or 1,758,147 and or 1,882,341, as the case may be."

The policy of serving purchasers with notice that its combustion stoker switch carries with it a license to use the system shown in the Cross patents has been continuously followed by Minneapolis-Honeywell Regulator Company to as late as 1940.

14. Plaintiff Mid-Continent Investment Company did not practice the invention but received its revenue from the sale of combustion stoker switches made and sold by its exclusive licensee and sub-licensee both of which conveyed with the sale of each combustion stoker switch a license to use the domestic heating system covered by the Cross patent No. 1,758,146.

Plaintiff Mid-Continent Investment Company has attempted through its method of business to expand the scope of its domestic heating system patent to monopolize the sale of combustion stoker switches not covered by said Cross heating system patent.

15. During February 1932, plaintiff Minneapolis-Honeywell Regulator Company addressed and mailed a letter to a general list of stoker manufacturers entitled "Re: Cross Patents" in which it announced that Minneapolis-Honeywell Regulator Company had obtained an exclusive license under the Cross patents Nos. 1,758,146 and 1,758,147. The letter stated said Cross patents do not
cover individual controls as such and because these
1151 patents cover a system involving the controls and the stoker and not the controls alone, Minneapolis-Honeywell Regulator Company had worked out a special plan whereby a license under these patents would be granted by it to the purchaser of its special stoker controls through the inclusion of one of these units, the

entire stoker installation would be licensed under one of the above named patents.

Several months thereafter, plaintiff Mid-Continent Investment Company addressed and mailed a letter to the stoker manufacturers calling attention to the same patents as being owned by the Mid-Continent Investment Company and stated the sale of a stoker together with such an instrument, or the sale of the instrument alone constitutes an infringement of these patents, and suggested that, in the purchase of control instruments, the purchaser ascertain if he was also purchasing rights under the above named patents so that he would be fully protected in this matter.

In 1934, Mid-Continent Investment Company wrote a customer of the defendant that it had been recently called to its attention that the customer was purchasing controls from a company not licensed by Mid-Continent Investment Company to sell controls; that Mid-Continent Investment Company wished to make this a formal notification that it considered the sale and use of controls for this purpose an infringement of the Cross patent No. 1,758,146.

The parties plaintiff herein, as shown in the record of this case, through these letters to customers of defendant, have entered into unfair competition with defendant in an attempt to establish a monopoly in the sale of unpatented combustion stoker switches or low limit controls.

16. After bringing suit against Smith in 1935, Mid-Continent Investment Company first attempted to submit a license under said Cross patent No. 1,758,146 to
1152 the defendant and the license was later submitted by the other party plaintiff Minneapolis-Honeywell Regulator Company to The Mercoid Corporation under the same general terms as expressed in the sub-license Minneapolis-Honeywell Regulator Company granted to Detroit Lubricator Company, requiring The Mercoid Corporation to pay $1.25 upon the sale of each of its patented M-61 controls.

17. On November 24, 1939, Mid-Continent Investment Company wrote defendant calling attention to the Mid-Continent *vs.* Smith suit; that The Mercoid Corporation assumed the defense in this action, and that the installation in the Smith home was a Mercoid installation furnished and installed through one of the Mercoid dealers. This letter also stated The Mercoid Corporation was notified by Mid-Continent Investment Company during the

year 1932 that the sale and installation of Mercoid controls for maintaining a fire bed in a coal stoker fed furnace constituted an infringement of Cross patent No. 1,758,146; that inasmuch as the Cross patent had been adjudicated as valid and infringed by The Mercoid Corporation, Mid-Continent Investment Company, before the institution of an action for damages, was writing The Mercoid Corporation to inquire whether or not it desired to discuss the question of settlement of damages.

Thereafter, Mid-Continent Investment Company submitted a license to defendant which required The Mercoid Corporation to pay $1.00 for the sale of each of its patented M-61 controls, and in addition, pay Mid-Continent Investment Company the sum of $5,000.00 for the past sales of its patented M-61 controls. Minneapolis-Honeywell Regulator Company, the exclusive licensee under the Cross patent No. 1,758,146, was willing to allow Mid-Continent Investment Company to execute the proposed license with The Mercoid Corporation.

1153 18. The parties plaintiff, Mid-Continent Investment Company and Minneapolis-Honeywell Regulator Company, by offering and acquiescing in the offer of Mid-Continent Investment Company to grant the defendant a license in 1935, upon the payment of royalty of $1.25 for the sale of each Mercoid M-61 control, patented per se by The Mercoid Corporation, and in 1940, upon the payment of a royalty of $1.00 for the sale of each M-61 control, patented per se by The Mercoid Corporation; have in collusion conspired with each other in an attempt to monopolize the sale of combustion stoker switches, stoker controls or low limit controls, not covered by the Cross patent No. 1,758,146 and patented per se by The Mercoid Corporation. The parties plaintiff have attempted to collect $5,000.00 for past sales of defendant's M-61 controls not covered by the Cross patent and patented per se by The Mercoid Corporation.

19. The parties plaintiff have conspired with each other and with the sub-licensee Detroit Lubricator Company to establish a monopoly in the sale in interstate commerce of combustion stoker switches, or low limit controls, in violation of the Anti-Trust Laws of the United States.

20. Defendant is a manufacturer of temperature responsive controls for heating systems and is not in the business of installing automatic coal stokers with an automatic control system therefor.

Defendant makes and has made low limit controls since prior to 1925, which are capable of use in automatic coal stoker heating systems to prevent the fire in the furnace from going out during long periods of mild weather.

1154 Conclusions of Law.

1. Neither defendant nor a dealer of defendant installed the heating system in the Smith residence held to be an infringement of the Domestic Heating System patent to Cross No. 1,758,146. Mid-Continent *vs.* Smith is not *res adjudicata* against the defendant as to contributory infringement of the Cross patent, the defense of laches, or the defense that plaintiff has attempted through its method of doing business to expand its patent to monopolize the sale of combustion stoker switches.

2. Plaintiff Mid-Continent Investment Company, through its predecessor in title Cross Coal-O-Matic Company, had knowledge of defendant's low limit control prior to the granting of the patent in suit, and Cross Coal-O-Matic Company requested and received from defendant, in 1930, suggestions as to the use of its controls for the purpose of preventing the fire from going out. Plaintiff Mid-Continent Investment Company sent defendant a formal notice of infringement of the patent in suit November 21, 1932; but waited until September 10, 1940, before it brought suit against defendant for contributing to the infringement of said patent.

3. Plaintiff Mid-Continent Investment Company is barred from maintaining this cause of action by reason of laches. *Wheatley v. Rex-Hide*, 25 F. Supp. 543; 102 F. (2d) 940.

4. The patented Mercoid M-61 stoker control is a modification of the patented Mercoid Figure 50 furnace control on the market in 1925. The Mercoid M-61 was not built for the express purpose of providing purchasers with means to perform the Cross patented heating system and does not contribute to the infringement of the Cross patent in suit. The Mercoid TJV and JMV controls do not
1155 contribute to the infringement of the Cross patent here in suit.

5. Plaintiff Mid-Continent Investment Company's method of doing business falls within the condemnation of

*Carbice Corporation v. American Patents Development Corporation*, 283 U. S. 27, and *Leitch Mfg. Co. v. Barber Company*, 302 U. S. 485, as the practical equivalent of granting a written license with the condition that the patented system may be practiced only with combustion stoker switches purchased from its licensees. The patent is being utilized to gain a monopoly beyond its legitimate scope and its sole purpose as used by plaintiff Mid-Continent Investment Company is to suppress competition in the manufacture and sale of combustion stoker switches.

6. Plaintiff Mid-Continent Investment Company's method of doing business leads to the suppression of competition in unpatented appliances and is sufficient to deny the relief sought in its bill of complaint.

7. Plaintiff Mid-Continent Investment Company is not in a position to maintain this suit: *American-Lecithin v. Warfield*, 105 F. (2d) 207 (C. C. A. 7).

8. Plaintiff Mid-Continent Investment Company has conspired with its licensees. The exclusive licensee, plaintiff Minneapolis-Honeywell Regulator Company, having developed its combustion stoker switch independently of the Cross patent and marketed it before the grant thereof, conspired with Mid-Continent Investment Company in restraint of trade in interstate commerce and conspired to establish a monopoly in interstate commerce in an unpatented appliance beyond the scope of the patent in suit in violation of the Anti-Trust Laws.

9. Plaintiffs' combination constitutes a restraint of trade, an attempt to monopolize, and monopolization under Title 15, Sections 1 and 2, U. S. C. A., and the 1156 defendant is entitled to injunctive relief under Title 15, Section 4, U. S. C. A.

Igoe,
*United States District Judge.*

January 6th, 1942.

Counsel will submit appropriate order.

Igoe.

## Final Decree.

This cause having come on to be heard on final hearing on the pleadings and proofs, having been argued by counsel, considered by the Court and Findings of Fact and Conclusions of Law having heretofore been entered:

It Is Hereby Ordered, Adjudged And Decreed:

That the bill of complaint be and is hereby dismissed;

That a perpetual injunction be issued out of and under the seal of this Court restraining and enjoining Mid-Continent Investment Company and Minneapolis-Honeywell Regulator Company, and each of them, their officers, agents, attorneys, servants, employees and all others acting by and under their direction or authority, their successors or assigns, from bringing suit for contributing to the infringement of the patent in suit against defendant's customers or prospective customers, or directly or indirectly threatening defendant's customers or prospective customers with suit for contributory infringement of the patent in suit or from, in any manner, interfering with defendant's business by use of the patent in suit;

That the exclusive license granted by Mid-Continent Investment Company to Minneapolis-Honeywell Regulator Company to make, use and sell and to sub-license others to make, use and sell the invention of the system patent in suit upon the payment of a royalty on each sale of an unpatented appliance, and by conveying with each sale
1157 of said unpatented appliance in interstate commerce by Minneapolis-Honeywell Regulator Company a license to practice the invention of the patent in suit constitutes a conspiracy and combination in restraint of trade in violation of Title 15, Sections 1 and 2, U. S. C. A.;

That a perpetual injunction be issued out of and under the seal of this Court restraining, enjoining and prohibiting Mid-Continent Investment Company of Minneapolis-Honeywell-Regulator Company, their officers, agents, servants, and employees, and all persons acting under, through or on behalf of them, or any of them, individually and collectively:

a. From further engaging in or carrying out said conspiracy or any other conspiracy similar to, or having a purpose or effect similar to said conspiracy and involving the patent in suit;

b. From doing any act or thing whatsoever having the same purpose or effect as the acts done in pursuance of said conspiracy, or promoting, or tending to promote, any of the purposes and effects thereof and involving the patent in suit;

c. From enforcing or carrying out, directly or indirectly, any of the provisions of the aforesaid license or sub-licenses or any other license or sub-licenses identical therewith or similar thereto, or having the same purpose or effect as the aforesaid license or sub-licenses and involving the patent in suit;

That defendant's counterclaim insofar as it relates to collection of damages suffered by defendant is dismissed;

That defendant recover of the plaintiffs its taxable costs;

That the injunction ordered herein shall not become effective until 45 days from the date hereof.

Enter,

Igoe,
*U. S. District Judge.*

Date: January 26, 1942.

1158 And on, to wit, the 14th day of February, A. D. 1942, came Wilfred S. Stone and filed in the Clerk's office of said Court a certain Withdrawal of Appearance, in words and figures following, to wit: Filed Feb. 14 1942.

1159 In the District Court of the United States.

(Caption—2070)

WITHDRAWAL OF APPEARANCE.

Please withdraw my appearance in the above entitled cause. The Firm of Spencer, Marzall, Johnston and Cook remains as attorney of record for the Plaintiffs.

Wilfred S. Stone.

February 13 1942.

Received a copy of the foregoing withdrawal of Appearance this 14 day of February, 1942.

Langdon Moore,
*Attorneys for Defendant.*

1160 And on, to wit, the 14th day of February, A. D. 1942, came the Plaintiff by its attorneys and filed in the Clerk's office of said Court its certain Appearance, in words and figures following, to wit:

1161 IN THE DISTRICT COURT OF THE UNITED STATES.

(Caption—2070)

APPEARANCE.

Please enter my appearance as additional counsel for the plaintiff, Mid Continent Investment Company, in this case.

Richard L. Johnston,
135 South La Salle Street,
Chicago, Illinois,
Central 5030.

Please enter the appearance of Richard L. Johnston as additional counsel for the plaintiff, Mid Continent Investment Company, in this case.

Spencer, Marzall, Johnston & Cook,
Spencer, Marzall, Johnston & Cook,
135 South La Salle Street,
Chicago, Illinois,
Central 5030.

Received a copy of the foregoing Appearance this 14 day of February, 1942.

Langdon Moore,
*Attorney for Defendant.*

1162 And afterwards, to wit, on the 17th day of March, A. D. 1942, being one of the days of the regular March term of said Court, in the record of proceedings thereof, in said entitled cause, before the Honorable Michael L. Igoe, District Judge, appears the following entry, to wit:

1163 In the District Court of the United States. Entered Mar. 17, 1942

(Caption—2070)

## ORDER.

Now on this 17th day of March, 1942, this matter coming on for hearing on the application of Minneapolis-Honeywell Regulator Company, and the Court being advised:

It Is Hereby Ordered that the injunction heretofore ordered in this cause be stayed so far as it applies to the existence and operation of the license contract between the Minneapolis-Honeywell Regulator Company and Mid-Continent Investment Company, and the distribution, use and sale of Minneapolis-Honeywell Regulator Company's catalogs, literature and controls as heretofore done, until appeal is taken and an order entered on the mandate
1164 following such appeal, or until the expiration of time for the taking of appeal in this case, if no appeal is taken.

Igoe,
*Judge.*

Approved:

Spencer, Marzall, Johnston & Cook,
Spencer, Marzall, Johnston & Cook,
*Counsel for Mid-Continent Investment Co.*

Langdon Moore,
Langdon Moore,
*Counsel for The Mercoid Corporation.*

Bair & Freeman,
Bair & Freeman,
*Counsel for Minneapolis-Honeywell Regulator Company.*

1165 And on, to wit, the 25th day of April, A. D. 1942, came the Plaintiff Appellant by its attorneys and filed in the Clerk's office of said Court its certain Notice of Appeal in words and figures following, to wit:

Filed Apr. 25, 1942

1166 IN THE DISTRICT COURT OF THE UNITED STATES

For the Northern District of Illinois,

Eastern Division.

| | |
|---|---|
| Mid-Continent Investment Company, a corporation, and Minneapolis-Honeywell Regulator Company, *Plaintiffs*, vs. The Mercoid Corporation, *Defendant*. | Civil Action No. 2070. |

## NOTICE OF APPEAL.

Mid-Continent Investment Company and Minneapolis-Honeywell Regulator Company, the plaintiffs in the above-entitled cause, hereby appeal to the United States Circuit Court of Appeals for the 7th Circuit from the decree or judgment of the District Court of the United States for the Northern District of Illinois, Eastern Division, in said cause entered on the 26th day of January, 1942. The plaintiff, Mid-Continent Investment Company, appeals particularly from so much of said decree or judgment which adjudges:

(1) That the Bill of Complaint filed in the above-entitled case is dismissed;

Each of the plaintiffs, Mid-Continent Investment Company and Minneapolis-Honeywell Regulator Company appeals from so much of said decree of judgment which adjudges:

(2) That an injunction be issued restraining and enjoining Mid-Continent Investment Company and Minneapolis-Honeywell Regulator Company, their officers,
1167 agents, attorneys servants, employees, and others, acting by and under their direction or authority, their successors or assigns, from bringing suit for contributing to the infringement of the patent in suit against defendant's, The Mercoid Corporation, customers or prospective customers, or directly or indirectly threatening defendant's customers or prospective customers with suit for contributory infringement of the patent in suit, or from, in any

manner, interfering with defendant's business by use of the patent in suit.

(3) That the exclusive license granted by Mid-Continent Investment Company to Minneapolis-Honeywell Regulator Company to make, use and sell and to sub-license others to make, use and sell the invention of the system patent in suit upon the payment of a royalty on each sale of an unpatented appliance, and by conveying with each sale of said unpatented appliance in interstate commerce by Minneapolis-Honeywell Regulator Company a license to practice the invention of the patent in suit, constitutes a conspiracy and combination in restraint of trade in violation of Title 15, Sections 1 and 2, U. S. C. A.

(4) That injunction be issued restraining, enjoining, and prohibiting Mid-Continent Investment Company and Minneapolis-Honeywell Regulator Company, their officers, agents, servants and employees, or persons acting under, through or on behalf of them, or any of them, from further engaging in or carrying out said conspiracy or any other conspiracy similar to, or having a purpose or effect similar to said conspiracy and involving the patent in suit; and from doing any act or thing whatsoever having the same purpose or effect as the acts done in pursuance of said conspiracy, or promoting, or tending to promote, any of the purposes and effects thereof and involving the 1168 patent in suit; and from enforcing or carrying out, directly or indirectly, any of the provisions of the aforesaid license or sub-licenses, or any other license or sub-licenses identical therewith or similar thereto, or having the same purpose or effect as the aforesaid license or sub-licenses and involving the patent in suit.

(5) That defendant recover of the plaintiffs its taxable costs.

Mid-Continent Investment Company,
*Appellant,*
By Spencer, Marzall, Johnston & Cook,
*Its Attorneys.*

Of Counsel:
Richard L. Johnston.

Minneapolis-Honeywell Regulator Company,
*Appellant,*
By Bair & Freeman,
*Its Attorneys.*

Of Counsel:
Will Freeman,
W. P. Bair.

1169 And on, to wit, the 4th day of May, A. D. 1942, came the Plaintiff-Appellant by his attorneys and filed in the Clerk's office of said Court his certain Statement of Points in words and figures following, to wit:

1170 In the District Court of the United States.

(Caption—2070)

STATEMENT OF POINTS UPON WHICH THE APPELLANT MID-CONTINENT INVESTMENT COMPANY INTENDS TO RELY ON THE APPEAL.

Now comes the plaintiff, Mid-Continent Investment Company, by its attorneys, Spencer, Marzall, Johnston and Cook, and Richard L. Johnston, of Suite 2805, 135 South La Salle Street, Chicago, Illinois, under and in accordance with the provisions of Rule 75 (d) of the Federal Rules of Civil Procedure and states that it has designated for inclusion in the appeal record the complete record and all the proceedings and evidence in the action, save only for the omission as required by Rule 75 (c) of all matters not essential to the decision of the questions presented by the appeal, and the omission of all formal and irrelevant parts of the exhibits and other documents.

Because of such compliance by the appellant with the requirements of Rule 75 (c), appellant states that the points upon which it intends to rely on the appeal are:

1171 (1) That the decree signed by Judge Igoe, dated filed and entered January 26, 1942, should be reversed;

(2) That the plaintiff, Mid-Continent Investment Company, has not attempted through its method of doing business to expand the scope of its domestic heating system patent to monopolize the sale of combustion stoker switches not covered by said Cross heating system patent;

(3) That the parties plaintiff herein, as shown in the Record of this case through certain letters to customers of defendant, as stated in Finding of Fact 15, have not entered into unfair competition with defendant in an attempt to establish a monopoly in the sale of unpatented combustion stoker switches of low limit controls;

(4) That the parties plaintiff, Mid-Continent Investment Company and Minneapolis-Honeywell Regulator

Company, by offering and acquiescing in the offer of Mid-continent Investment Company to grant the defendant a license in 1935 upon the payment of a royalty of $1.25 for the sale of each Mercoid M-61 Control and in 1940 upon the payment of a royalty of $1.00 for the sale of each M-61 Control have not conspired with each other in an attempt to monopolize the sale of combustion stoker
1172 switches, stoker controls, or low limit controls not covered by the Cross patent No. 1,758,146;

(5) That the parties plaintiff have not conspired with each other and with the sublicensee, Detroit Lubricator Company, to establish a monopoly in the sale in interstate commerce of combustion stoker switches or low limit controls in violation of the Anti-Trust Laws of the United States;

(6) That the lower court erred in holding that Mid-Continent *vs.* Smith is not res adjudicata against the defendant as to contributory infringement against the Cross patent, the defense of laches, or the defense that the plaintiff has attempted through its method of doing business to expand its patent to monopolize the sale of combustion stoker switches;

(7) That the lower court erred in holding that the plaintiff, Mid-Continent Investment Company, was barred from maintaining this cause of action by reason of laches;

(8) That the lower court erred in holding the Mercoid M-61 was not built for the express purpose of providing purchasers with means to perform the Cross patented heating system and does not contribute to the infringement of the Cross patent in suit and in further holding that the Mercoid TJV and JMV Controls do not contribute to the infringement of the Cross patent here in suit;

1173 (9) That the lower court erred in holding that the plaintiff Mid-Continent Investment Company's method of doing business falls within the condemnation of *Carbice Corporation* v. *American Patents Development Corporation*, 283 U. S. 27, and *Leitch Manufacturing Company* v. *Barber Company*, 302 U. S. 485, as the practical equivalent of granting a written license with the condition that the patented system may be practiced only with combustion stoker switches purchased from its licensees and in further holding that the patent is being utilized to gain a monopoly beyond its legitimate scope and that its sole

purpose as used by plaintiff, Mid-Continent Investment Company, is to suppress competition in the manufacture and sale of combustion stoker switches;

(10) That the lower court erred in holding plaintiff Mid-Continent Investment Company's method of doing business leads to the suppression of competition in unpatented appliances and is sufficient to deny the relief sought in its Bill of Complaint;

(11) That the lower court erred in holding that the plaintiff, Mid-Continent Investment Company, is not in a position to maintain this suit;

(12) That the lower court erred in holding that the plaintiff, Mid-Continent Investment Company, has conspired with its licensees to establish a monopoly in
1174 inter-state commerce in an unpatented appliance beyond the scope of the patent in suit in violation of the Anti-Trust Laws;

(13) That the lower court erred in holding plaintiffs' combination constitutes a restraint of trade, an attempt to monopolize, and monpolization under Title 15, Sections 1 and 2, U. S. C. A., and that the defendant is entitled to injunctive relief under Title 15; Section 4, U. S. C. A.;

(14) That the lower court erred in dismissing the Bill of Complaint;

(15) That the lower court erred in not adjudging that the conduct of the Mid-Continent Investment Company in licensing the Minneapolis-Honeywell Company under its patent, covering a system, to practice the invention, and in determining the number of such systems in existence by the sale of a particular element of that system, the royalties being computed on the basis of the number of those elements sold by the Minneapolis-Honeywell Company; where that particular element was generally recognized to last the life of the system, where that element was not sold by Minneapolis-Honeywell Company for any other purpose than for use in the patented system, and where that element was an active part of the system, was within its rights under the Patent Laws;

1175 (16) That the lower court erred in not adjudging that the owner of a combination patent covering a system is within his rights, under the Patent Laws, to require of his licensee that the payment of royalties be based on the sale of a particular element of that system, where that element is made expressly for use in the patented

system and the sale of that element establishes that a system covered by the patent will be created, thus using the element merely as a measure for determining the number of patented systems in existence.

(47) That the lower court erred in not adjudging that the defendant, Mercoid Corporation, having openly defended the Smith suit, is now estopped from raising the defense of laches or the defense that the plaintiff, Mid-Continent Investment Company, has attempted through its method of doing business to expand its patent to monopolize the sale of combustion stoker switches and from asserting that the plaintiffs' method of doing business is in violation of the Anti-Trust Laws or from asserting any other points or raising any other defenses which could have been raised in the Smith suit in Missouri.

Mid-Continent Investment Company,
By Spencer, Marzall, Johnston & Cook,
Richard L. Johnston,
*Of Counsel for the Plaintiff,*
2805, 135 S. La Salle Street,
Chicago, Illinois.

Chicago, Illinois,
May 4, 1942.

Copy hereof received this 4th day of May, 1942.
Langdon Moore,
L. Kerans Moore.

1175½ And on, to wit, the 4th day of May, A. D. 1942 came the Minneapolis-Honeywell Regulator Company by its attorneys and filed in the Clerk's office of said Court Its certain Statement of Points in words and figures following, to wit:

Filed May 4, 1942.

1176 IN THE DISTRICT COURT OF THE UNITED STATES.

* * (Caption—2070). * *

## STATEMENT OF POINTS ON WHICH MINNEAPOLIS-HONEYWELL REGULATOR COMPANY WILL RELY ON APPEAL.

Minneapolis-Honeywell Regulator Company, plaintiff, states that the following are the points upon which it intends to rely on the appeal.

The Court below erred—

1. In adjudging that the exclusive license granted by Mid-Continent Investment Company to Minneapolis-Honeywell Regulator Company to make, use and sell and to sublicense others to make, use and sell the invention of the system patent in suit upon the payment of a royalty on each sale of an unpatented appliance, and by conveying with each sale of said unpatented appliance in interstate commerce by Minneapolis-Honeywell Regulator Company a license to practice the invention of the patent in suit constitutes a conspiracy and combination in restraint of trade in violation of Title 15, Sections 1 and 2, U. S. C. A.

1177 2. In adjudging that Minneapolis-Honeywell Regulator Company engaged in "a conspiracy and combination in restraint of trade in violation of Title 15, Sections 1 and 2" when it took a license (dated December 31, 1938) from Mid-Continent Investment Company under the Cross Patent in suit No. 1,758,146 and, acting thereunder and, with each sale of a "combustion stoker switch * * *" defined as a "combination stoker control unit including an automatic electric switch responsive directly to temperatures of combustion gases or boiler water produced by an automatic coal fuel stoker and adapted, in combination with other devices and apparatus, for the control of automatically operated coal fuel stokers, to prevent the extinguishment of its fire when operating under low heat requirement conditions," (the last quotation is from paragraph 2 of the license contract), conveyed to the purchaser a license under said patent No. 1,758,146, to use the control in the patented system.

3. In adjudging and decreeing that a perpetual injunction be issued out of and under the seal of this Court

restraining and enjoining Mid-Continent Investment Company and Minneapolis-Honeywell Regulator Company, and each of them, their officers, agents, attorneys, servants, employees and all others acting by and under their direction or authority, their successors or assigns, from bringing suit for contributing to the infringement of the patent in suit against defendant's customers or prospective customers, or directly or indirectly threatening defendant's customers or prospective customers with suit for contributory infringement of the patent in suit or from, in any manner, interfering with defendant's business by use of the patent in suit.

1178 4. In adjudging and decreeing that a perpetual injunction issue restraining, enjoining and prohibiting Minneapolis Honeywell Regulator Company from further engaging in or carrying out said conspiracy or any other conspiracy similar to, or having a purpose or effect similar to said conspiracy and involving the patent in suit.

5. In adjudging and decreeing that a perpetual injunction issue restraining, enjoining and prohibiting Minneapolis-Honeywell Regulator Company from doing any act or thing whatsoever having the same purpose or effect as the acts done in pursuance of said conspiracy, or promoting, or tending to promote, any of the purposes and effects thereof and involving the patent in suit.

6. In adjudging and decreeing that a perpetual injunction issue restraining, enjoining and prohibiting Minneapolis-Honeywell Regulator Company from enforcing or carrying out, directly or indirectly, any of the provisions of the aforesaid license or sub-licenses or any other license or sub-licenses identical therewith or similar thereto, or having the same purpose or effect as the aforesaid license or sub-licenses and involving the patent in suit.

7. In adjudging that defendant recover of the plaintiffs its taxable costs.

8. In Finding (No. 9) that "Plaintiff Minneapolis-Honeywell Regulator Company does not make or install heating systems."

1179 9. In Finding (No. 18) that the parties plaintiff, Mid-Continent Investment Company and Minneapolis-Honeywell Regulator Company, by offering and acquiescing in the offer of Mid-Continent Investment Company to grant the defendant a license in 1935, upon the

payment of royalty of $1.25 for the sale of each Mercoid M-61 control, patented per se by The Mercoid Corporation, and in 1940, upon the payment of a royalty of $1.00 for the sale of each M-61 control, patented per se by The Mercoid Corporation, have in collusion conspired with each other in an attempt to monopolize the sale of combustion stoker switches, stoker controls or low limit controls, not covered by the Cross patent No. 1,758,146 and patented per se by The Mercoid Corporation.

10. In Finding (No. 19) that the parties plaintiff have conspired with each other and with the sub-licensee Detroit Lubricator Company to establish a monopoly in the sale in interstate commerce of combustion stoker switches, or low limit controls, in violation of the Anti-Trust laws of the United States.

11. In the "Conclusion of Law" (No. 8) that the exclusive licensee, plaintiff Minneapolis-Honeywell Regulator Company, having developed its combustion stoker switch independently of the Cross patent and marketed it before the grant thereof, conspired with Mid-Continent Investment Company in restraint of trade in interstate commerce and conspired to establish a monopoly in interstate commerce in an unpatented appliance beyond the scope of the patent in suit in violation of the Anti-Trust Laws.

1180 12. In the "Conclusion of Law" (No 9) that plaintiffs' combination constitutes a restraint of trade, an attempt to monopolize, and monopolization under Title 15, Sections 1 and 2, U. S. C. A., and the defendant is entitled to injunctive relief, under Title 15, Section 4, U. S. C. A.

13. In not dismissing the suit on the counterclaim against Minneapolis-Honeywell Regulator Company for lack of equity.

14. In not adjudging that the conduct of Minneapolis-Honeywell Regulator Company, as shown by the evidence, was within its rights under the patent laws.

15. In failing to adjudge that the granting and taking of the license of December 31, 1938, from Mid-Continent Investment Company to Minneapolis-Honeywell Regulator Company, and the conveying by Minneapolis-Honeywell Regulator Company with each sale thereunder of a "combination stoker switch" a license to practice the invention

under the Cross patent No. 1,758,146, did not constitute a conspiracy and combination in restraint of trade.

Minneapolis-Honeywell Regulator Company,
By .....
*Its Attorneys.*

Of Counsel:

.....

.....

.....

Dated: Chicago, Illinois, April ....., 1942.

1181 IN THE DISTRICT COURT OF THE UNITED STATES,

For the Northern District of Illinois,

Eastern Division.

CERTIFICATE OF MAILING.

I, Hoyt King, Clerk of the United States District Court, for the Northern District of Illinois, Eastern Division, keeper of the Seal and Records of said Court, do hereby certify that on the 28 day of April, 1942, in accordance with Rule 73 (b) of the Rules of Civil Procedure for District Courts of the United States, I did cause to be mailed a copy of the foregoing Notice of Appeal to the following attorney of record:

Langdon Moore,
53 West Jackson Blvd.,
Chicago, Illinois.

Hoyt King,
Hoyt King,
(Seal) *Clerk.*

Filed May 9, 1942. 1182 And on, to wit, the 9th day of May, A. D. 1942, came the Appellant by its attorneys and filed in the Clerk's office of said Court its certain Bond on Appeal, in words and figures following, to wit:

1183 APPEAL BOND FOR COST.

Know All Men By These Presents: That we, Mid-Continent Investment Company, a Missouri Corporation, and Minneapolis-Honeywell Regulator Company, a Delaware Corporation, as Co-Principals and, Maryland Casualty Company, a Maryland Corporation, of Baltimore, Maryland, as Surety, are held and firmly bound unto The Mercoid Corporation, a Delaware Corporation, in the full and just sum of Two Hundred And Fifty Dollars ($250.00) to be paid to the said Mercoid Corporation, their attorneys, executors, administrators or assigns; to which payment well and truly to be made, we bind ourselves, our heirs, executors and administrators, jointly and severally, firmly by these presents.

Sealed with our seals and dated this 4th day of May, A. D. 1942.

Whereas, lately at a session of the District Court of the United States for the Northern District of Illinois, in a suit pending in said court between the Mid-Continent Investment Company, Minneapolis-Honeywell Regulator Company, plaintiffs, and The Mercoid Corporation, defendant, a decree was rendered against the Mid-Continent Investment Company and Minneapolis-Honeywell Regulator Company, dismissing the case and the said Mid-Continent Investment Company and Minneapolis-Honeywell Regulator Company have filed their notice of appeal for the United States Circuit Court of Appeals for the Seventh Circuit in the Clerk's Office of the said District Court to reverse the decree of the aforesaid suit in the United States Circuit Court of Appeals for the Seventh Circuit to be holden at Chicago within forty days from the date hereof.

Now, The Condition Of This Obligation Is Such, That if the said Mid-Continent Investment Company and Minneapolis-Honeywell Regulator Company shall pay the cost if the appeal is dismissed or such cost as the Circuit Court of Appeals for the Seventh Circuit may award if the de-

cree is modified, then the above obligation is to be void; otherwise to remain in full force and effect.

Mid-Continent Investment Company,
By (s) Forbes Cross,
(Seal) *President.*
Attest:
Walter M. Cross, Jr.,
*Secretary.*

Minneapolis-Honeywell Regulator Company,
By W. L. Huff,
(Seal) *Vice President and Treas.*
Attest:
D. C. Owens,
*Secretary.*

Maryland Casualty Company,
By (s) J. A. Lemmon, Jr.
(Seal) J. A. Lemmon, Jr.

1184 And on, to wit, the 25th day of April, A. D. 1942, came the Defendant, Appellee by its attorneys and filed in the Clerk's office of said Court its certain Notice of Appeal, in words and figures following, to wit: Filed Apr. 25, 1942

1185 IN THE DISTRICT COURT OF THE UNITED STATES,

For the Northern District of Illinois,

Eastern Division.

| | |
|---|---|
| Mid-Continent Investment Company, a Corporation, and Minneapolis-Honeywell Regulator Company, *Plaintiffs,* vs. The Mercoid Corporation, *Defendant.* | Civil Action No. 2070. |

## NOTICE OF APPEAL.

Notice is hereby given that The Mercoid Corporation, defendant above named, hereby appeals to the Circuit Court of Appeals for the Seventh Circuit from that part.

of the Final Decree entered herein on the 26th day of January, 1942, dismissing its counterclaim insofar as it relates to collection of damages suffered by defendant.

Langdon Moore,
L. Kerans Moore,
*Attorneys for The Mercoid Corporation,*
53 West Jackson Boulevard,
Chicago, Illinois.

Dated: Chicago, Illinois, April 25th, 1942.

Filed May 8 1942.

1186. And on, to wit, the 8th day of May, A. D. 1942, came the Defendant-Appellee by its attorneys and filed in the Clerk's Office of said Court its certain Statement of Points, in words and figures following, to wit:

1187. IN THE DISTRICT COURT OF THE UNITED STATES.

(Caption—2070)

STATEMENT OF POINTS UPON WHICH THE APPELLANT THE MERCOID CORPORATION INTENDS TO RELY ON ITS APPEAL.

1. The Court erred in dismissing defendant's counterclaim insofar as it relates to collection of damages suffered by the defendant.

2. The Court erred in not finding defendant damaged by the wrongful acts of the parties plaintiff.

3. The Court erred in not applying a reasonable royalty to the loss of sales suffered by defendant in estimating damages as shown by the evidence.

4. Having found the parties plaintiff have entered into unfair competition with defendant, the Court erred in dismissing defendant's counterclaim without referring the matter of damages to a Master.

5. Having found the patent is being utilized to gain a monopoly beyond its legitimate scope and its sole purpose as used by plaintiff Mid Continent Investment Company is to suppress competition in the manufacture and sale of combustion switches, the Court erred in not adjudg-
1188 ing that an accounting be awarded to defendant of plaintiff Mid Continent Investment Company's

profits, gains and advantages and the damage sustained by defendant because of plaintiff Mid-Continent Investment Company's wrongful and unlawful acts.

6. Having found the exclusive licensee, plaintiff Minneapolis-Honeywell Regulator Company, developed its combustion stoker switch independently of the Cross patent and marketed it before the grant thereof and thereafter conspired with Mid-Continent Investment Company in restraint of trade in interstate commerce, and conspired to establish a monopoly in interstate commerce in an unpatented appliance beyond the scope of the patent in suit in violation of the Anti-Trust Laws, the Court erred in not adjudging that an accounting be awarded to the defendant of profits, gains and advantages of Minneapolis-Honeywell Regulator Company, and the damage sustained by defendant because of the wrongful and unlawful acts of said Minneapolis-Honeywell Regulator Company.

7. Having found plaintiffs' combination constitutes a restraint of trade, an attempt to monopolize and monopolization under Title 15, Sections 1 and 2, U. S. C. A., the Court erred in not adjudging that defendant recover from plaintiffs Mid-Continent Investment Company and Minneapolis-Honeywell Regulator Company three-fold the
1189 damage by it sustained on account of said unlawful restraint in trade in violation of the Anti-Trust Laws and recover a reasonable attorneys' fee.

The Mercoid Corporation,
By Langdon Moore,
L. Kerans Moore,
*Its Attorneys,*
53 West Jackson Boulevard,
Chicago, Illinois.

1190 In the District Court of the United States,

For the Northern District of Illinois,

Eastern Division.

CERTIFICATE OF MAILING.

I, Hoyt King, Clerk of the United States District Court, for the Northern District of Illinois, Eastern Division, keeper of the Seal and Records of said Court, do hereby

certify that on the 28th day of April, 1942, in accordance with Rule 73 (b) of the Rules of Civil Procedure for District Courts of the United States, I did cause to be mailed a copy of the foregoing Notice of Appeal to the following attorneys of record:

Spencer, Marzall, Johnston & Cook,
135 South La Salle St.,
Chicago, Illinois.
Bair & Freeman,
1400—135 South La Salle,
C.

Hoyt King,
(Seal) Hoyt King,
*Clerk.*

Filed Apr. 25, 1942.

1191. And on, to wit, the 25th day of April, A. D. 1942, came the Defendant Appellee by its attorneys and filed in the Clerk's office of said Court its certain Bond on Appeal, in words and figures following, to wit:

1192 Know All Men By These Presents:

That we, The Mercoid Corporation, as principal, and Continental Casualty Company, as sureties, are held and firmly bound unto Mid-Continent Investment Company and Minneapolis-Honeywell Regulator Company in the full and just sum of Two Hundred and Fifty and no 100 ($250.00) Dollars to be paid to the said Mid-Continent Investment Company and Minneapolis-Honeywell Regulator Company, their attorneys, executors, administrators, or assigns; to which payment, well and truly to be made, we bind ourselves, our heirs, executors, and administrators, jointly and severally, firmly by these presents. Sealed with our seals and dated this 20th day of April, in the year of our Lord one thousand nine hundred and forty two.

Whereas, lately at a session of the District Court of the United States for the Northern District of Illinois, Eastern Division, in a suit pending in said Court, between Mid-Continent Investment Company and Minneapolis-Honeywell Regulator Company, plaintiffs, and The Mercoid Corporation, defendant, a decree was rendered against said The Mercoid Corporation, and said The Mercoid Corporation having filed its notice of appeal to the United

States Circuit Court of Appeals for the Seventh Circuit in the Clerk's Office of the said District Court to reverse the decree of the aforesaid suit in the United States Circuit Court of Appeals for the Seventh Circuit, to be holden at Chicago within forty days from the date hereof.

1193 Now, the condition of the above obligation is such, that if said The Mercoid Corporation shall prosecute its said appeal to effect, and shall answer all damages and costs that may be awarded against it if it fail to make its plea good, then the above obligation to be void; otherwise to remain in full force and virtue.

The Mercoid Corporation,
By Hugh Courteol,
*President.*

(Seal)

Attest:
J. F. Chambliss,
*Secretary.*

Continental Casualty Company,
By John H. R. Jamar,
*Its Attorney-in-Fact.*

State of Illinois, } ss.
County of Cook. }

On this 20th day of April, A. D. 1942, before me the undersigned, a Notary Public, within and for the said County and State, personally appeared Hugh Courteol, President, and J. F. Chambliss, Secretary, of the above named The Mercoid Corporation, to me known to be the persons who executed the foregoing instrument, and to me known to be such President and Secretary of said corporation, and acknowledged that they executed the
1194 foregoing instrument as such officers as the deed of said corporation, by its authority.

Albert Schiff,
*Notary Public.*

(Seal)

My Commission Expires April 9, 1944.

State of Illinois, }
County of Cook. } ss.

On this 21st day of April, A. D. 1942, before me, the undersigned, a Notary Public, within and for said County and State, personally appeared John H. R. Jamar, Attorney in-Fact of the above named Continental Casualty Company to me known to be the person who executed the foregoing instrument, and to me known to be such Attorney-in-Fact of said corporation, and acknowledged that he executed the foregoing instrument as such Attorney-in-Fact, as the deed of said corporation, by its authority.

Beryl M. Radcliffe,
(Seal) *Notary Public.*

Filed May 4, 1942.

1195 And on, to wit, the 4th day of May, A. D. 1942 came the Plaintiff-Appellant by its attorneys and filed in the Clerk's office of said Court its certain Designation of Contents of Record on Appeal in words and figures following to wit:

1196 IN THE DISTRICT COURT OF THE UNITED STATES.

(Caption—2070)

## DESIGNATION OF CONTENTS OF RECORD ON APPEAL.

Now come the appellants, Mid-Continent Investment Company by its attorneys Spencer, Marzall, Johnston and Cook, and Richard L. Johnston, of 2805, 135 South La Salle Street, Chicago, Illinois, and Minneapolis-Honeywell Regulator Company by its attorneys Bair and Freeman of 1400, 135 South La Salle Street, Chicago, Illinois, under and in accord with the provisions of Rule 75 (a) of the Federal Rules of Civil Procedure and designate the following as portions of the record, proceedings, and evidence to be contained in the record on appeal (formal parts of all exhibits and more than one copy of any document to be excluded and documents to be abridged by omitting all irrelevant and formal portions thereof as provided in Rule 75 (e)):

1197 1. Bill of Complaint, omitting Exhibits A, B and C attached thereto, being duplicates of Mid-Continent's Exhibits 1, 2 and 3, respectively;

2. Defendant's Answer to the Bill of Complaint and Counter-Claim, omitting the Exhibits attached thereto;

3. Motion that Minneapolis-Honeywell Regulator Company be made additional party plaintiff;

4. Order that Minneapolis-Honeywell Regulator Company be made additional party plaintiff;

5. Reply of Mid-Continent Investment Company to defendant's Counter-Claim;

6. Reply of Minneapolis-Honeywell Regulator Company to defendant's Counter-Claim, omitting the Exhibit attached thereto;

7. Order of March 8, 1941, omitting all of page 1 except that part which reads as follows:

"Order * * * This cause coming on to be heard on two motions of the defendant, * * * and upon three motions of the plaintiff Mid-Continent Investment Company, * * *" and omitting lines 1 and 2 lines 4-9, inclusive, on page 2;

8. Replies to the Interrogatories propounded by the defendant to Minneapolis-Honeywell Regulator Company, dated March 28, 1941, pages 1-5, inclusive;

9. Amendment to defendant's Answer to plaintiffs' Bill of Complaint, omitting Exhibits attached thereto;

10. Reply of Mid-Continent Investment Company to the Amendment to defendant's Answer to plaintiffs' Bill of Complaint;

11. Reply of Minneapolis Honeywell Regulator Company to Amendment to defendant's Answer to plaintiff's Bill of Complaint.

12. Findings of Fact, Conclusions of Law, and Decree;

13. Order entered March 17, 1942, staying the injunction;

1198 14. Such part of the evidence and proceedings at the trial which was stenographically reported as is contained in pages 1 and 2 and in pages 66-788, beginning with line 10 on page 66 and including the first 15 lines on page 788 upon the two copies of the Reporter's Transcript of said evidence and proceedings which are attached to and filed with this Designation under and in accord with the provisions of Rule 75 (b);

The parts so designated upon said copies for inclusion in the Record on Appeal are hereby incorporated in this Designation but referred to the same extent as though the words and figures thereof were fully set forth herein;

Since this Designation includes only part of the Reporter's Transcript, the said two copies of the evidence

and proceedings at the trial include also (but not designated for inclusion in the Record on Appeal) two copies of such additional parts thereof as the appellee may need to enable him to designate the parts he desires to have added;

One of the copies so filed by the appellants with this Designation shall be available for the use of the other party to the appeal and for use in the Appellate Court in printing the Record;

15. Plaintiffs' Exhibits to be reproduced in the Appeal Record:

(1) Mandate of the Circuit Court of Appeals for the 8th Circuit in the Suriff-suit—Exhibit No. 3;

(2) Page 12 of Mercoid Catalogue No. 100, dated February 1, 1936—Exhibit No. 4;

(3) Copy of assignment of patent in suit from Cross Coal-O-Matic Company to Plaintiff—Exhibit No. 5;

(4) Copy of license agreement between Cross Coal-O-Matic Company and Butler Manufacturing Company and Minneapolis-Honeywell Regulator Company—Exhibit No. 6;

1199 (5) Copy of license agreement between plaintiff and Minneapolis-Honeywell Regulator Company Dated Dec. 31, 1938—Exhibit No. 7;

(6) Copy of Cross patent in suit No. 1,758,146—Exhibit No. 8;

(7) Bulletin 241-A of 1935 of Mercoid Corporation—Exhibit No. 10;

(8) Page 24 of Catalogue No. 100, dated February 1936, of Mercoid Corporation—Exhibit No. 11;

(9) Bulletin No. 240 of Mercoid Corporation—Exhibit No. 12;

(10) Advertisement of Mercoid Corporation appearing in "Coal Heat" magazine of November 1933—Exhibit No. 14;

(11) Form P-90 installation instruction of Mercoid Corporation, September 1937—Exhibit No. 15;

(12) Front page of bulletin issued by Mercoid Corporation on Mercoid Stokatherm, Type JMV—Exhibit No. 16;

(13) Circular letter dated August 7, 1936, on stationery of Mercoid Corporation—Exhibit No. 17;

(14) Copy of report by the Anthracite Institute Laboratory, No. 2192 on Mercoid Stokatherm, Type JMV addressed to The Mercoid Corporation—Exhibit No. 18;

(15) Copy of Bulletin No. 242 of Mercoid Stokatherm, Type JMV, dated 6-36—Exhibit No. 19;

(16) General applications of wiring diagrams of Mercoid Corporations—Exhibit No. 20;

(17) Bulletin of The Mercoid Corporation covering Mercoid Controls, furnace stoker, etc., Form A-30—Exhibit No. 21;

(18) Advertising circular of The Mercoid Corporation, no date shown—Exhibit No. 22;

1200 (19) Letter on Mercoid Corporation letterhead dated January 22, 1934, entitled "Mercoid Controls—Manufacturers Schedule"—Exhibit No. 23;

(20) Bulletin Form No. A-51 dated January 15, 1934, entitled "Manufacturers Prices"—Exhibit No. 24;

(21) Copy of two clippings from magazines, one from the "American Artisan" dated July 19, 1932, the other from "Heating, Piping and Air Conditioning" magazine for July, 1932—Exhibit No. 25;

(22) Copy of four clippings from magazines; first from "Sheet Metal Worker" for November, 1929; second, "Sanitary Heating Age," August, 1929; third, "Fuel Oil Journal," April, 1928; fourth, "Warm Air Heating," December, 1929—Exhibit No. 26;

(23) Page 7 from Mercoid Bulletin A-14 relating to the M-61 Stoker Control—Exhibit No. 29;

(24) Copy of page 38 of defendant's Catalogue No. 400, dated February, 1930—Exhibit No. 30;

(25) Copy of letter from Richard Spencer to Langdon Moore, dated July 15th—Exhibit No. 31;

(26) Letter from Langdon Moore to Richard Spencer, dated July 16th—Exhibit No. 32;

(27) Letter from Richard Spencer to Langdon Moore, dated July 17th—Exhibit No. 33;

(28) Letter from Langdon Moore to Richard Spencer, dated July 18th—Exhibit No. 34;

(29) Letter from Langdon Moore to Richard Spencer, dated July 24th—Exhibit No. 35;

(30) Drawings of systems submitted to witness Cook—Exhibit No. 46;

1201 (31) Page 5 of Mercoid Catalogue No. 11 of February 1, 1936, showing Stokatherm TJV—Exhibit No. 48;

(32) Form letter, Mercoid Corporation, dated February 26, 1930—Exhibit No. M-H 1;

16. Plaintiff's Exhibits to be transmitted by the Clerk as physical exhibits;

(a) Copy of Transcript of Record in Missouri suit—Exhibit No. 27;

(b) Reproduction of wiring diagram and infringing installation in the Smith home—Exhibit No. 37;

(c) Enlarged reproduction of diagram No. 1 of Exhibit 12—Exhibit No. 38;

(d) Sketch showing the way a V2-3A relay would be connected in wiring system shown in Exhibit 40—Exhibit No. 39;

(e) Enlarged replica of solid line portons of diagram No. 1 of Exhibit 12—Exhibit No. 40;

(f) Reproduction of diagram 9 on page 6 of plaintiff's Exhibit 12—Exhibit No. 41;

(g) Stokatherm TJV 3—Exhibit No. 42;

(h) Mercoid M-11 Type thermostat—Exhibit No. 43;

(i) Type JMV Stokatherm—Exhibit No. 44;

(j) Reproduction of diagram at lower lefthand corner of back page of Exhibit 19—Exhibit No. 45;

(k) Control of M-61 of Mercoid Corporation—Exhibit No. 49;

(l) Sleeve for JMV Stokatherm—Exhibit No. 50;

1202 17. Defendant's Exhibits to be reproduced in the Appeal Record:

(1) Photostat of Mercoid Bulletin E-1 of March 1925—Exhibit A;

(2) Copy of McCabe patent No. 1,734,046—Exhibit B;

(3) Photostat of Federal Mercoid Controls, Bulletin D, dated April 1924—Exhibit C;

(4) Photostat of Federal Mercoid Bulletin C, dated April 1923—Exhibit C-1;

(5) Photostat of Mercoid No. 848 Mercoid Control, Industrial Type—Exhibit D;

(6) Photostat of cover page and pages 18, 24 and 25 of Mercoid Catalogue H-5, dated 1929—Exhibit E;

(7) Photostat Mercoid Warm Air Furnace Control Bulletin S-83—Exhibit F;

(8) Copy of McCabe patent No. 1,834,288—Exhibit G;

(9) Photostat of Mercoid publication "Mercoid System of Direct Control"—Exhibit G-1;

(10) Cover page bearing copyright notice and page 11 photostat of cover page and pages 12, 20, 21, 24, 25, 31 and 32 of Mercoid Catalogue No. H-5, dated 1930—Exhibit H;

(11) Copy of McCabe patent No. 1,762,183—Exhibit H-1;

(12) Photostat of Honeywell Specialties and Honeywell System of Hot Water Heating, cover page and pages 22, 23, 24 and 25—Exhibit I-1;

(13) Photostat of cover page of Honeywell Heating Specialties and pages 4, 14, 15, 18, 19 and 28—Exhibit I-2;

(14) Photostat—Heart of the Heating Plant, cover and pages 3 and 8—Exhibit I-3;

1203 (15) Photostats of cover page and pages O-1, O-10, O-11 and O-24 of "Automatic Controls" of Time-O-Stat Company—Exhibit I-4;

(16) Photostats of front page and pages 23, 26 and last page of Minneapolis-Honeywell Regulator Company Catalogue—Exhibit J;

(17) Photostats of Bulletin A-14 of Mercoid Corporation entitled "Automatic Controls for Stokers and Forced Draft"—Exhibit K;

(18) Photostat of Mercoid Bulletin 230, dated March 1933—Exhibit K-1;

(19) Copy of Bulletin No. 240-B of Mercoid Corporation, June 1935—Exhibit M;

(20) Copy of Mercoid Installation Instructions Form P-90—Exhibit N;

(21) Bulletin No. 241 entitled "Mercoid Stokatherm Control System", dated October, 1935—Exhibit O;

(22) Photostats of pages 1, 18, 20, 22, and 38 of Catalogue No. 400, dated February, 1940—Exhibit Q;

(23) Photostats of pages 1, 2, 7, 8 and 9 of Detroit Lubricator Company Bulletin No. 62, dated September 30, 1933—Exhibit R;

(24) Photostats of pages 1 and 3 of Detroit Lubricator Company Sheet No. 101-L, dated September 15, 1937—Exhibit S;

(25) Photostats of cover page and pages 12 and 16 of Minneapolis-Honeywell Regulator Company condensed complete Catalogue and Price List, dated March 30, 1933—Exhibit T;

(26) Photostat of cover and pages 17 and 40 of the Minneapolis-Honeywell Automatic Control condensed Catalogue of 1940—Exhibit U;

1204 (27) Photostat of Penn Electric Switch Bulletin No. 56, dated 6-8-33—Exhibit V;

(28) Stem Patent No. 1,882,341—Exhibit W;

(29) Jones Patent No. 1,969,136—Exhibit W-1;

(30) Correspondence between Brownell Company and Mercoid in 1930—Exhibit X;

(31) Letter from American Radiator Company to Mercoid; letter from Mercoid to Cross Coal-O-Matic Company and Slipping Notice all dated June, 1929—Exhibit Y;

(32) Correspondence between Cross Coal-O-Matic and Mercoid Corporation—Exhibit Z;

(33) Bulletin A-5 of Mercoid Corporation—Exhibit Z-1;

(34) Correspondence between Mercoid Corporation and Frederick Iron and Steel Company in 1933—Exhibit AA;

(35) Correspondence between Mercoid Corporation and Minneapolis-Honeywell Regulator Company—Exhibit BB;

(36) Letter to Julius K. Luthe, September 25, 1931—Exhibit EE;

(37) Memorandum on calendar pad, December 7, 1931—Exhibit FF;

(38) Brownell letters re Cross patents in 1932—Exhibit GG;

(39) Letter from Will Burt Company to Mercoid, dated February 29, 1932, enclosing copy of letter from Minneapolis Honeywell—Exhibit HH;

(40) Letter to Will Burt Company from Mercoid Corporation, dated June 4, 1931—Exhibit HH-1;

(41) Combustioneer letter to The Mercoid Corporation, dated June 14, 1932—Exhibit II;

(42) Guarantee against infringement suits—Exhibit II-1;

(43) Letter from Bardes Stoker Works to Mercoid, dated October 7, 1932—Exhibit JJ;

1205 (44) Paragon, Kol-Master letter of October 12, 1933—Exhibit KK;

(45) Mid Continent Investment Company letter of November 21, 1932—Exhibit LL;

(46) Fairbanks Morse and Company letter of June 5, 1934—Exhibit MM; Copy of Mid Continent Investment Co. letter of June 2, 1934;

(47) Brownell letter of December 18, 1934—and carbon—Exhibit NN; copy of letter dated May 21, 1934;

(48) Sale Chart—Stokers and Controls—Exhibit OO;

(49) Letter from Minneapolis Honeywell Company and Mid Continent Investment Company to Ira E. McCabe and Mercoid Corporation in 1935—Exhibit PP;

(50) Proposed License Agreement, 1935—Exhibit QQ;

(51) Correspondence between Mid-Continent and Spencer, Marzall, Johnston and Cook, 1939-1940—Exhibit RR;

(52) Photostat of Agreement proposed by Mid Continent Company to Mercoid Corporation dated 1940—Exhibit SS;

(53) Photostat of letter from Minneapolis-Honeywell to Langdon Moore re Shipley patent, dated December 2, 1935—Exhibit TT;

(54) Copies of patents: Shipley No. 2,117,514; Brownell No. 2,064,193; Burton No. 2,064,194; Benjamin No. 2,109,939; Shipley No. 2,063,898—Exhibit UU;

(55) Sublicense Agreement between Minneapolis-Honeywell and Detroit Lubricator—Exhibit VV;

(56) Agreement as furnished by Minneapolis-Honeywell in its pleadings—Exhibit WW;

(57) Breakdown of Exhibit OO—Exhibit XX;

18. Defendant's Exhibits to be transmitted by the Clerk as physical exhibits:

(a) Mercoid Control M-51—Exhibit E-1;

(b) Mercoid Pyratherm M-1—Exhibit H-2;

(c) Mercoid Control M-55—Exhibit K-2;

1206 19. Withdrawal of appearance of Wilfred S. Stone;

20. Entry of appearance of Richard L. Johnston;

21. Notice of Appeal filed by Mid Continent Investment Company and Minneapolis-Honeywell Regulator Company on April 25, 1942;

22. Cost Bond of Plaintiffs;

23. Notice of Appeal filed by Mercoid Corporation on April 25, 1942;

24. Cost Bond of Mercoid, filed April 25, 1942;

25. The original Stenographer's Transcript of the Minutes of the Record, Evidence and Proceedings at the trial to be transmitted to the Circuit Court of Appeals as a physical exhibit only;

26. A Transcript of the docket entries in this action;

27. Appellant, Mid-Continent Investment Company's Statement of Points on which it intends to rely on the appeal under Rule 75 (d) and under Rule 9 of the United States Court of Appeals;

28. Appellant Minneapolis-Honeywell Regulator Company's Statement of Points on which it intends to rely on the appeal under Rule 75 (d) and under Rule 9 of the United States Court of Appeals;

29. Appellant Mercoid Corporation's Statement of Points on which it intends to rely on the appeal under Rule 75 (d) and under Rule 9 of the United States Court of Appeals;

30. This Designation of Contents of Record on Appeal.

Mid Continent Investment Company,
By Spencer, Marzall, Johnston & Cook.

Richard L. Johnston,
*Of Counsel for the Plaintiff.*
2805, 135 S. La Salle Street,
Chicago, Illinois.

Minneapolis-Honeywell Regulator Company,
By Bair & Freeman.

W. P. Bair,
*Of Counsel for the Plaintiff.*
1400, 135 S. La Salle Street,
Chicago, Illinois.

Chicago, Illinois
May 4, 1942

Copy hereof received this 4th day of May, 1942.
Langdon Moore,
L. Kerans Moore.

1207 And on, to wit, the 8th day of May, A. D. 1942 came the Defendant Appellee by its attorneys and filed in the Clerk's office of said Court its certain Additional Portions of Record Designated in words and figures following, to wit:

1208 In the District Court of the United States. Filed, May 8, 1942.

(Caption—2070)

NOTICE.

To:

Spencer, Marzall, Johnston & Cook,
135 South La Salle Street,
Chicago, Illinois,
and
Bair & Freeman,
135 South La Salle Street,
Chicago, Illinois:

Please Take Notice that I am this day filing with the Clerk of the District Court the attached Additional Portions of the Record Designated by Appellee.

Langdon Moore,
E. Kerans Moore,
*Attorneys for The Mercoid Corporation,*
53 West Jackson Boulevard,
Chicago, Illinois.

Copy of the above Notice with Additional Portions of the Record Designated by Appellee attached thereto received this 8th day of May, 1942.

Spencer, Marzall, Johnston & Cook,
*Attorneys for Mid-Continent Investment Company,*
Bair & Freeman,
*Attorneys for Minneapolis-Honeywell Regulator Company.*

1209 In the District Court of the United States.

(Caption—2070)

ADDITIONAL PORTIONS OF THE RECORD DESIGNATED BY APPELLEE.

Now comes the appellee, The Mercoid Corporation, under the provisions of Rule 75 (a), Rules of Civil Procedure, and designates the following additional portions of the

record, proceedings and evidence to be contained in the record on appeal:

1. The following portions of Defendant's Motion for a Bill of Particulars filed October 7, 1940:

Page 1, the heading "Defendant's Motion for a Bill of Particulars" only,

Page 3, with the exception of the first 6 lines,

Pages 4 and 5.

2. Bill of Particulars filed October 8, 1940.

3. Order entered January 20, 1941.

4. Interrogatories Propounded by the defendant to Minneapolis Honeywell Regulator Company, one of the parties plaintiff, under Rule 33, Rules of Civil Procedure, filed March 7, 1941, omitting the attached exhibits.

1210 5. All of the sheets of the Department of Commerce Bureau of Census Bulletins headed "Mechanical Stokers" dated December 1932, December 1933, December 1935, December 1936, December 1937, December 1938, December 1939 and December 1940, and the Affidavit forming a part of Defendant's Exhibit OO, not designated by appellants in Item 48 of appellant's Designation of Contents of Record on Appeal.

6. Order entered May 8, 1942.

7. This additional designation of record on appeal.

8. Clerk's Certificate.

The Mercoid Corporation,
By Langdon Moore,
L. Kerans Moore,
*Its Attorneys.*
53 West Jackson Boulevard,
Chicago, Illinois.

Dated: Chicago, Illinois, May 8th, 1942.

1211 And afterwards, to wit, on the 8th day of May, A. D. 1942, being one of the days of the regular May term of said Court, in the record of proceedings thereof, in said entitled cause, before the Honorable Michael L. Igoe, District Judge, appears, the following entry, to wit:

1212 IN THE DISTRICT COURT OF THE UNITED STATES. Entered May 8, 1942

(Caption—2070)

## ORDER.

Upon all the proceedings had herein and upon the annexed Stipulation, it is hereby ordered that:

The Clerk of the Court amend on its face the Designation of Contents of Record on Appeal filed by plaintiffs, Mid-Continent Investment Company and Minneapolis-Honeywell Regulator Company, in accordance with the annexed stipulation.

Igoe,
*U. S. District Judge.*

Dated:
Chicago, Illinois,
May 8, 1942.

1213 IN THE DISTRICT COURT OF THE UNITED STATES.

(Caption—2070)

## STIPULATION.

It is hereby stipulated and agreed by and between the parties to the above entitled cause through their attorneys, this Honorable Court consenting thereto, that the Designation of Contents of Record on Appeal filed May 4, 1942, by plaintiffs, Mid-Continent Investment Company and Minneapolis-Honeywell Regulator Company, be amended on its face by the Clerk of the Court to read as follows:

Page 2, Item (7), change "Order of March 10, 1941" to read Order of March 8, 1941.

Page 4, Item (5), line 3, change "toward end of" to read dated December 31.

Page 4, Item (7), insert of 1935, after "241 A."

Page 5, Item (23), after "Page" insert 7.

Page 7, Item (9), after "Control" insert cover page, page bearing copyright notice and page 11.

Page 7, Item (13), change "20" to 28.

Page 8, Item (19), change "October" to June.

1214 Page 8, Item (22) line 3, change "41" to 1.

Page 10, Item (46), after "1934," insert and copy

of Mid-Continent Investment Company letter of June 2, 1934.

Page 10, Item (47), after "1934" insert and carbon copy of letter dated December 21, 1934.

Page 10, Item (52), after "Corporation" insert dated 1940.

Spencer, Marzall, Johnston & Cook,
*Attorneys for Mid-Continent Investment Company.*

Dated:
May 6, 1942.

Barr & Freeman,
*Attorneys for Minneapolis-Honeywell Regulator Company.*

May 6, 1942.

Langdon Moore,
L. Kerans Moore,
*Attorneys for The Mercoid Corporation.*

May 6, 1942.

May 13, 1930. W. M. CROSS 1,758,146.

DOMESTIC HEATING SYSTEM

Filed Nov. 11, 1926 3 Sheets-Sheet 1

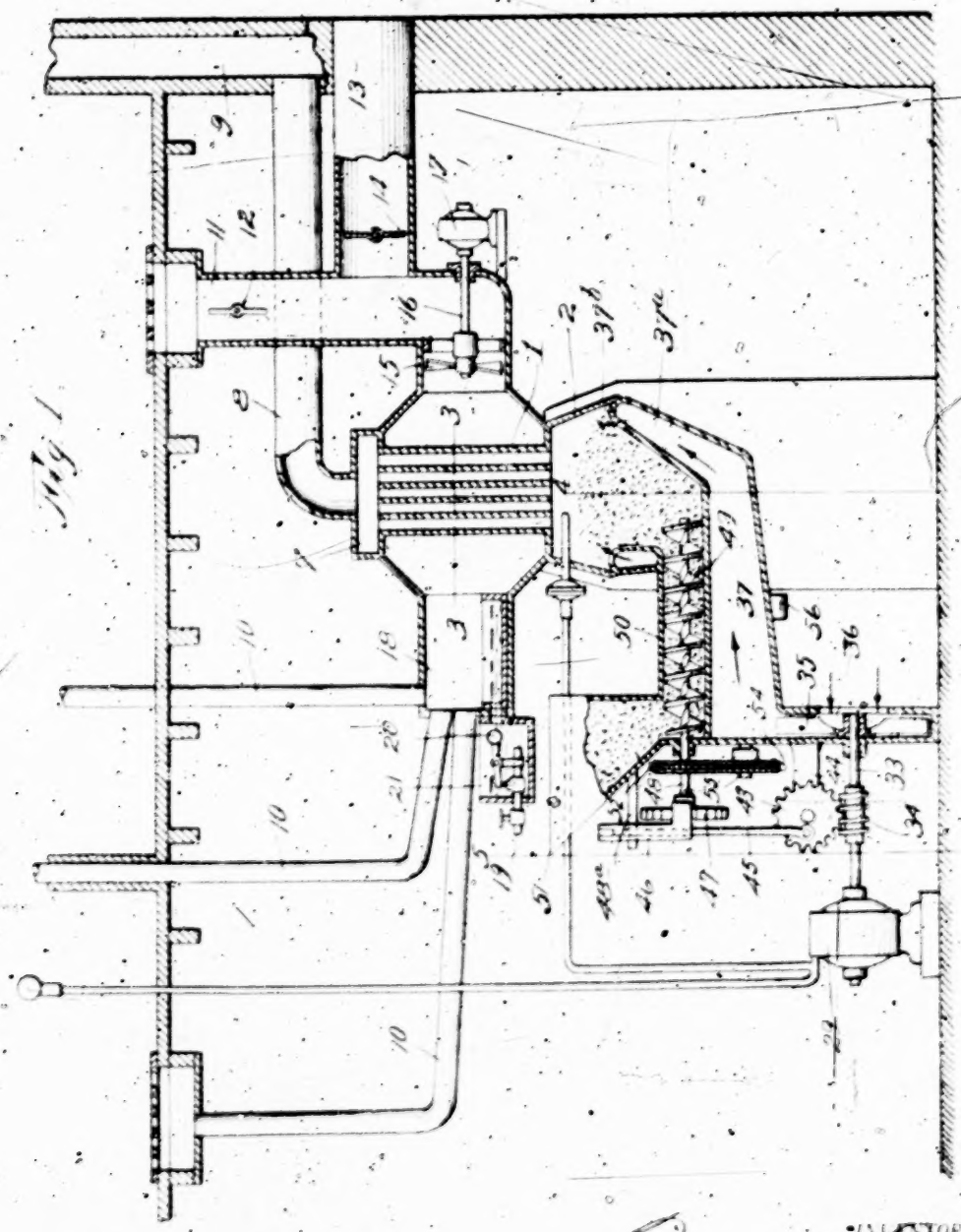


Fig. 1

INVENTOR
Walter M. Cross
BY
Thomas E. Penfield
ATTORNEY

Witness:
R. Chandler

780 May 13, 1930. W M CROSS 1,758,146

DOMESTIC HEATING SYSTEM

Filed Nov [illegible] 1926 3 Sheets-Sheet 2

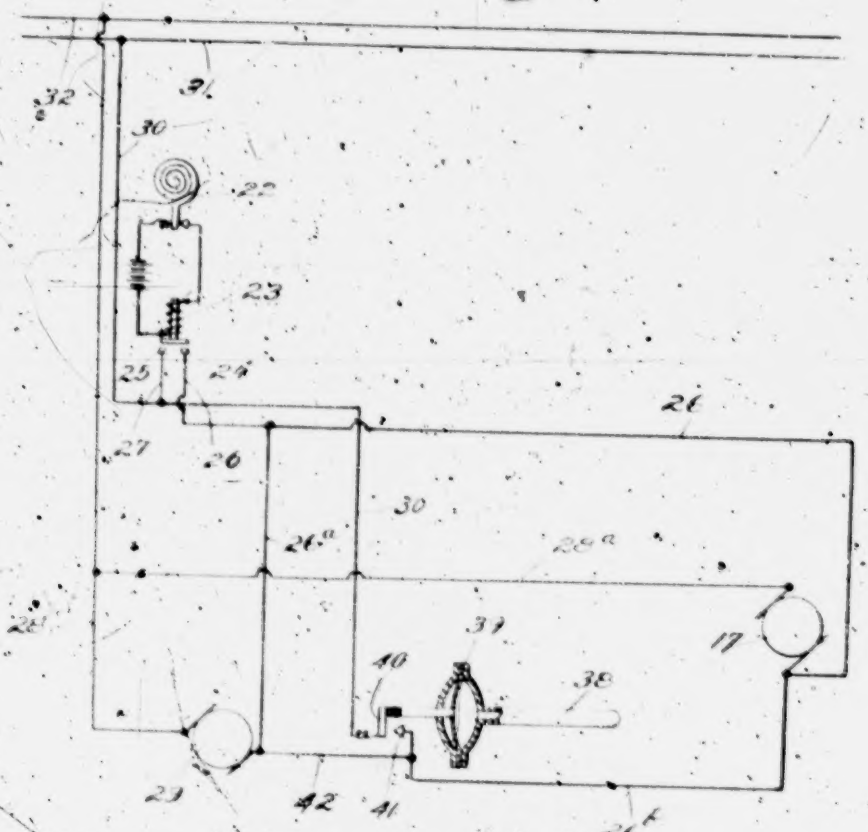



Fig. 2.

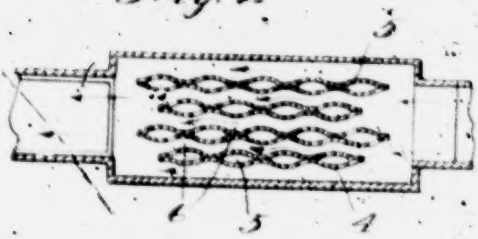



Fig 3

Witness
A. C. Hamilton

INVENTOR
Walter M. Cross
BY
Thomas E. Scofield
ATTORNEY

782

May 13, 1930. W. M. CROSS 1,758,146

DOMESTIC HEATING SYSTEM

Filed Nov. 11, 1926 3 Sheets-Sheet 3

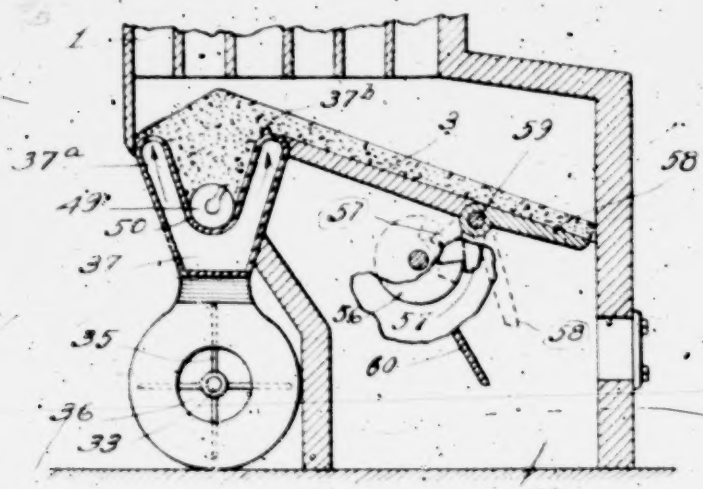



Fig 4

Fig 5

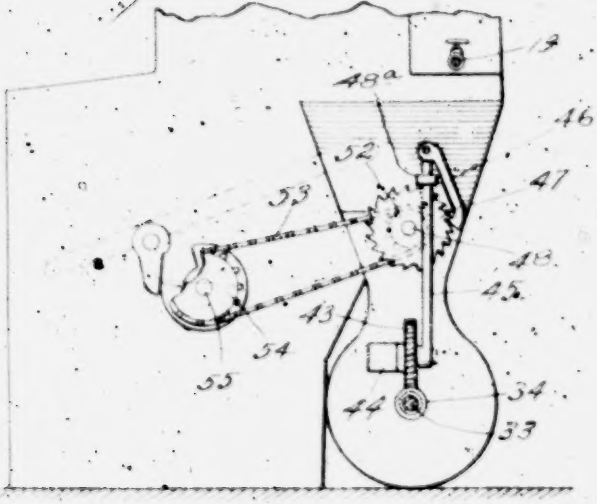
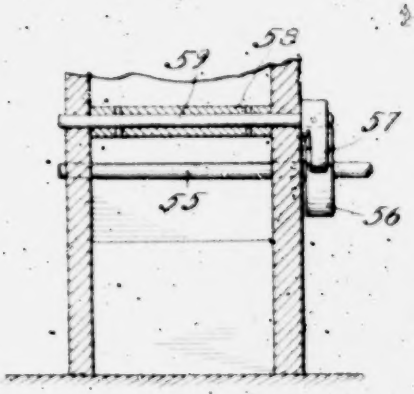



Fig 6




Witness

INVENTOR

Walter M. Cross

BY

ATTORNEY

Patented May 13, 1930. 1,758,146

783

# UNITED STATES PATENT OFFICE

WALTER M. CROSS, OF KANSAS CITY, MISSOURI, ASSIGNOR TO CROSS COAL-O-MATIC COMPANY, OF KANSAS CITY, MISSOURI, A CORPORATION OF MISSOURI

## DOMESTIC HEATING SYSTEM

Application filed November 11, 1926. Serial No. 147,667.

This invention relates to improvements in domestic heating systems, and refers more particularly to a hot air system of heating in which the combustion gases passing to the flue are reduced in temperature in their passage through a heat exchanging device below the kindling temperature of wood.

Among the particular objects of the invention are to provide a system having a furnace into which is mechanically and automatically fed a comminuted fuel, such as disintegrated coal, the fuel being underfed into the combustion pot, and overflowing onto an inclined grate, the grate terminating in automatic intermittently operated dumping device, whereby the ashes are removed from the grate and dumped directly into an ashpit; to provide a system which is automatically controlled by a dual system of control, one phase of the system operating the fuel feed and a force draft mechanism by variations in the room temperature of the dwelling, the other control functioning the fuel feed and force draft by predetermined minimum temperatures in the furnace or combustion pot, and in general to provide a system hereinafter described in more detail and incorporating a number of well known advantages of the modern type of heating system.

Fig. 1 is a diagrammatic side elevational view of a portion of the system, the furnace mechanism and its controls being shown in section, while the distributing pipes have been partially or totally eliminated for simplicity.

Fig. 2 is a detail view of the electrical control system.

Fig. 3 is a sectional view taken along the line 3—3 in Fig. 1, looking in the direction of the arrow.

Fig. 4 is a view taken along the line 4—4 in Fig. 1, looking in the direction of the arrow.

Fig. 5 is a view taken along the line 5—5 in Fig. 1, looking in the direction of the arrow, and

Fig. 6 is a fragmentary detail of a portion of the drive mechanism.

Referring to the drawings, at 1 is shown a heat exchanging device above a furnace comprising a combustion pot 2 and an inclined grate 3.

The heat exchanger consists in a plurality of corrugated sheets welded, or otherwise fastened together in pairs to produce a construction shown best in cross section in Fig. 3; these pairs of sheets are designated by the numeral 4 in Fig. 3, the tubular passageways produced by the pairing of the corrugated sheets are designated as 5, while the sinuous annular spaces between the elements 4 are designated as 6. The gases of combustion produced by the burning of fuel pass through the tubular passageways 5 and out through a top header 7 to the flue 8, and thence into the chimney 9.

The air which is heated and distributed through the pipe leads or distributing pipes 10 is supplied either through the return duct 11 controlled by a damper 12 or through an outside air inlet duct 13 regulated by a damper 14. A fan 15 mounted upon a shaft 16 and supported within the duct 11 is driven by a motor 17, the shaft of the motor carrying the fan being supported in suitable bearings in the duct. The purpose of the fan is to produce a positive circulation of the air through the system. This air, which is driven by the fan, is directed through an annular passageways 6 where it is heated, due to the fact that it brought in radiating contact with the highly heated outer surfaces of the tubular passageways 5 through which the combustion gases pass. On discharge from the heat exchanger the heated air passes through a humidifying chamber 18, in which is maintained a pool of water by a supply pipe 19, automatically controlled by a liquid level float 20, and valve 21; the control maintaining a constant water level in the humidifying chamber. After being humidified the heated air is directed through the respective distributing pipes or ducts 10, to the separate rooms of the dwelling, not shown in the drawings.

Referring now to the control which is detailed in Fig. 2. At 22 is a thermostat which controls the operation of the switch 23. 24 and 25 are contact points which are terminals of the lines 26 and 27 respectively. When the

temperature in the dwelling drops below the point at which the thermostat is set, the switch 23 is functioned, at which time the circuit is completed through the lines 26, 28ª and 28, and 26, 26ª and 28, starting the motors 17 and 29. The line 27 is connected by a line 30 to the power line 31, while the line 28 into which is connected the line 28ª has connection with the power line 32. When the circuit is closed and the motor 29 started the shaft 33, carrying the worm 34 and fan 35 is rotated, the fan drawing the air through an inlet duct 36 and discharging it through the ducts 37 into the open channels 37ª formed around the combustion pot 2, similar to an air jacket. The air is discharged from this jacket, or chamber, surrounding the combustion pot, through tuyères or openings 37ᵇ in the inner sides of the combustion pot near the surface of the burning fuel, or at a point substantially where the combustion takes place. To prevent the fire from being entirely extinguished during the periods when the system is shut off for any considerable length of time, a thermo-couple 38, shown in Figs. 1 and 2, is positioned in the combustion space of the furnace, just above the fire zone, and this thermo-couple is set at a predetermined temperature which temperature is regulated to operate the fuel feed and force drafts sufficiently to prevent total extinguishment of the fire. The variations in temperature acting upon the thermo-couple function a diaphragm valve 29 to bring a contacting surface 40 in engagement with the contact point 41 when the temperature in the furnace is reduced to a predetermined point. With the contacting of the elements 40 and 41, the electrical circuit is closed through the lines 30, 42 and 28, and 30, 26ª, 28ª, and 28 to start the motors 17 and 29 as they were started by the thermostat. The fire is continued until the furnace temperature is raised sufficiently high to break the contact between 40 and 41, shutting off the motors 17 and 29, which drive the fuel feed and force draft and the air circulation through the system.

Referring now to the drive for the fuel feed mechanism, the worm 34 meshes with a worm wheel 43, the latter being supported by a hanger 44. The lower end of the crank 45 is connected to the face of the worm wheel and is given a reciprocating movement, due to its offset position from the center of the wheel. This reciprocating movement is transferred to a dog 46, which engages the teeth of a ratchet wheel 47, the latter being mounted upon a shaft 48. The vertical reciprocating crank 45 slides in an upper guide member 48ª which prevents also displacement of the dog from the ratchet. Upon the shaft 48 is also mounted a conveyor screw, 49 operating in a pipe 50 which serves as a conveying duct between the hopper 51 and the combustion pot 2. The rotation of the conveyor screw transfers the fuel from the hopper to the combustion pot where it is underfed to the combustion pot. A sprocket wheel 52 is also mounted upon the shaft 48, and drives the chain 53 which runs over a sprocket 54 mounted upon a shaft 55. This shaft 55 also carries a cam wheel 56 which has a portion of its outer surfaces cut away. The outer surface of the cam 56 rides against a depending tongue 57 of the dump grate 58, which is positioned at the end of the inclined grate 33. Through a considerable part of the rotation of the cam the dump grate is held in the full line position shown in Fig. 4, but when the cut out portion is rotated so that the depending tongue can swing into a position shown in the dotted line position in Fig. 4, the grate being pivoted at 59 drops down, permitting the ashes or spent fuel gravitating along the inclined grate 3 to drop into the hopper 60 and thence into the ash-pit 61 below the furnace.

It is recognized to be common practice to circulate air through a furnace by means of a blower fan, and also to humidify this air prior to its distribution. It is recognized as common practice also to automatically stoke a furnace by means of a conveyor screw but to supply the fuel by an under feed device, and to inject the air substantially at the combustion point in the furnace and to allow the overflowing burning fuel from the combustion pot to gravitate downwardly over an inclined grate and at the end of this grate to automatically and intermittently dump the ashes into a pit, is thought to be a practice which is novel in the art.

Further more the dual electrical control apparatus—one control regulated by the variations in room temperature in the dwelling and a separate control operating simultaneously therewith functioned by a predetermined minimum temperature in the combustion zone of the furnace, constitutes another feature of the invention.

The fuel which is used is consumed always under the most economical conditions, as the system is either turned on full or entirely off, so that the most efficient operating conditions exist for combustion, or the system is what may be termed as in a smoldering or banked condition. There is no regulation of drafts as in the common type of hot air furnace, making for operation under varying conditions, none of which are perhaps economically proper and efficient for the fuel which is being used.

By this invention then, economical conditions of combustion are at all times enforced, for when the thermostat in the heated room reaches a predetermined temperature, there is a complete stoppage of the fuel feed mechanism and the forced draft fan. This permits then only the burning of the residual

fuel which when consumed would allow the fire to be entirely extinguished if it were not for the auxiliary control within the combustion pot, which functions when the furnace is cooled to say 200° F. This auxiliary control starting the fuel feed and force draft again institutes maximum operation until the temperature in the combustion pot is restored to 200° F., or at any other predetermined temperature selected for the minimum temperature of the furnace.

It may, under certain conditions, be desirable to have the auxiliary control or the control functioned by the furnace temperature connected only to the fuel feed and force draft, so that the air circulation or the operation of the fan 17 is dispensed with when the system is being operated to maintain the minimum furnace temperature.

In the construction of the heat exchanger 1, the relation of heating surface to fuel burned is at least that of 200 square foot surface per 1000 B. t. u. produced per minute. When this relation is used the stacked temperature is approximately 150° F. (a temperature well below the kindling temperature of soot or wood).

This mechanism then for the first time supplies a system in which under maximum operating conditions the stack temperatures are still below a temperature sufficiently high to burn or ignite wood or soot, and will at all times range below 250° F.

It is a well known fact that a large portion of the fires in domestic dwellings are occasioned by overheating of chimneys or flues connecting with the chimneys; a condition occasioned by high stack temperatures. By the use of the present invention these excessive stack temperatures would be impossible, as it would be impossible to operate the system so that the stack temperatures would rise above the kindling temperature of wood, as previously stated—this being due to the efficient heat exchange taken place between the combustion gases and circulating air. The relation then of the maximum combustion measured in B. t. u. units to the heating exchanging surface is such that the products of combustion are pooled to a temperature below the kindling temperature of wood or soot.

The system in combination with automatic stoker regulated simultaneously by a dual or double thermostatic control, which prevents the extinguishment of the fire and maintains a proper room temperature, comprises briefly the features of the system.

The furnace construction relies for its novelty upon underfeeding of a granulated or disintegrated fuel to a combustion pot and supplying air at substantially the combustion point; also, in the distributing of this overflowing burning fuel onto an inclined grate and automatically and intermittently dumping the ashes to a pit provided for that purpose.

I claim as my invention:

1. A heating system comprising a combustion pot, means for feeding fuel thereto, a combustion space above the combustion pot, means controlled by the temperature of the rooms to be heated for automatically regulating the fuel feeding means, and a separate thermostatic control actuated by predetermined minimum temperatures in said combustion space for preventing extinguishment of the fire when operating under low heat requirement conditions.

2. A heating system comprising a combustion pot, means for feeding fuel thereto, a combustion space above the combustion pot, means controlled by the temperature of the rooms to be heated for turning on and off the feeding means, and a separate thermostatic control actuated by a predetermined minimum temperature in said combustion space for preventing extinguishment of the fire when operating under low heat requirement conditions.

3. A heating system of the character described comprising a combustion pot, means for feeding fuel thereto, means for forcing air to said combustion pot, means controlled by the temperature of the rooms to be heated for automatically turning on and off the fuel feeding means and the air forcing means, a combustion space heated by said combustion pot and a separate thermostatic control actuated by a predetermined minimum temperature in the combustion space for preventing extinguishment of the fire when operating under low heat requirement conditions.

4. A domestic heating plant of the character described comprising a combustion pot, an automatic stoker adapted to supply fuel thereto, means controlled by the temperature of the rooms to be heated for turning on and off the stoker, and a separate thermostatic control actuated by the predetermined minimum temperature of the combustion space for preventing extinguishment of the fire when operating under low heat requirement conditions.

5. A forced draft furnace for a heating system having a power driven underfeed stoking element, a dual thermostatic control mechanism connected to the stoker driving means, one thermostat mechanism functioning by variations of the temperature in the space to be heated, and the other by predetermined minimum temperature within the furnace to prevent extinguishment of the fire.

WALTER M. CROSS.

788 Oct. 29, 1929. I. E. McCABE 1,734,016

PRESSURE ACTUATED CIRCUIT CONTROL

Filed Sept. 1 1922 2 Sheets-Sheet 1

Fig 1

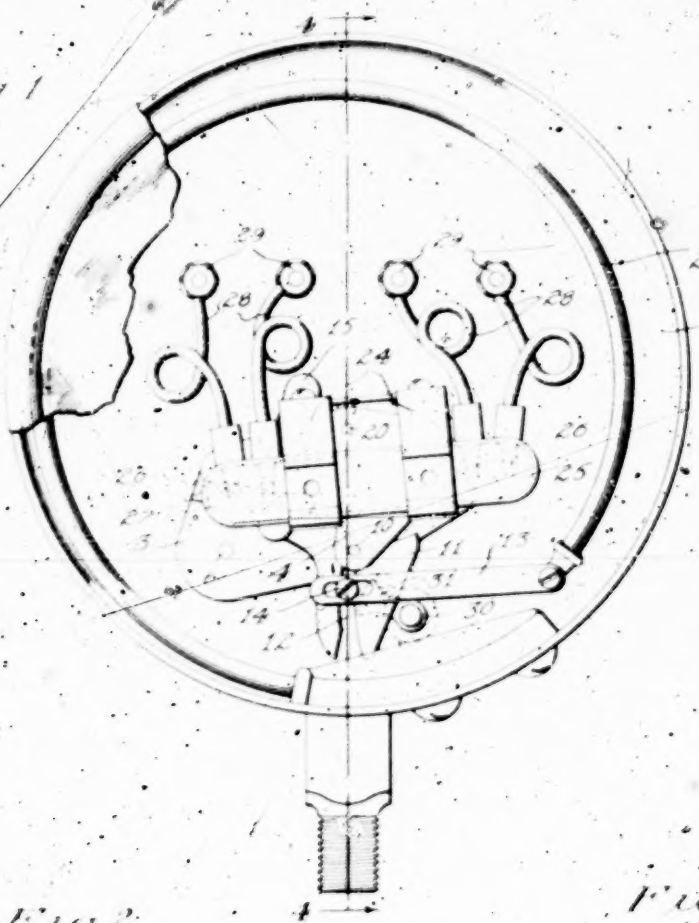


Fig 2

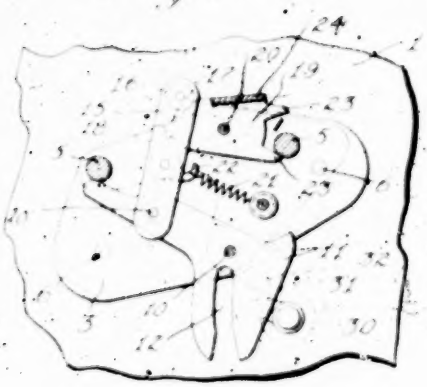
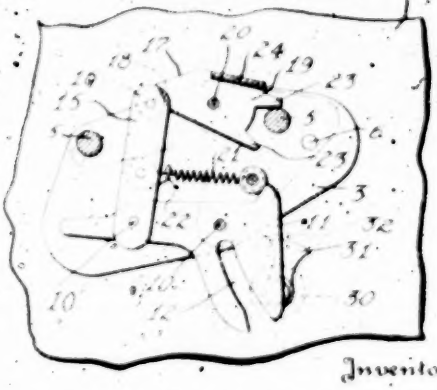


Fig 3



Inventor

Ira E. McCabe.

By Langdon Moore

Attorney

790 Oct. 29, 1929 I. E. McCABE 1,734,016

PRESSURE ACTUATED CIRCUIT CONTROL

Filed Sept. 1 1922 2 Sheets-Sheet 2

Fig 1

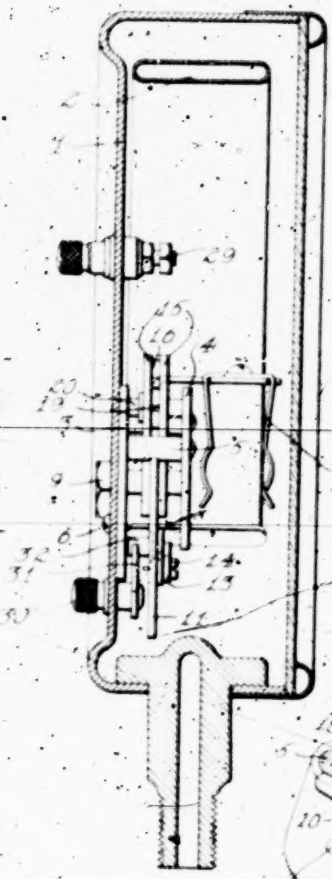


Fig 11

Fig 5

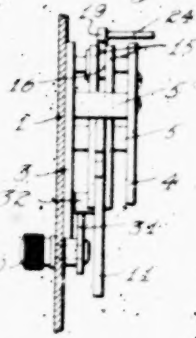


Fig 6

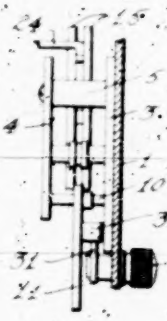


Fig 7

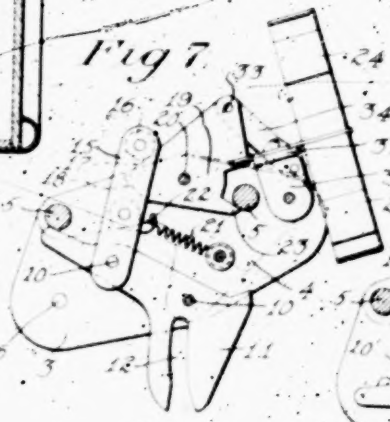


Fig 8

Fig 9

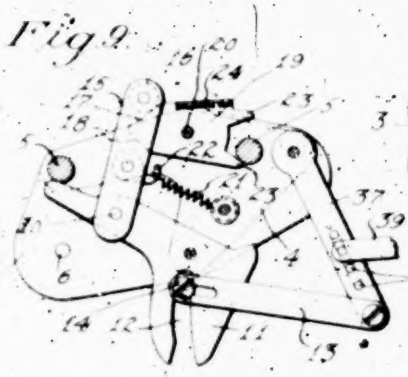


Fig 10

Inventor

Ira E McCabe

By Langdon Moore

Attorney

Patented Oct. 29, 1929 1,734,016

791

# UNITED STATES PATENT OFFICE

IRA E. McCABE, OF CHICAGO, ILLINOIS

## PRESSURE-ACTUATED CIRCUIT CONTROL

Application filed September 1, 1922. Serial No. 585,698.

This invention comprises a circuit controlling device. It is contemplated to provide a device for opening and closing a single or multiple circuit arrangement which will lend itself to a large variety of uses; which can be actuated from any form of prime moving device such as pressure actuated tubes of the Bourdon type, bellows, diaphragms, floats, thermostats, fusible metal or any of the like devices, which can be set for automatic operation to open or close a single circuit, or multiple circuits, to open one and close another, or several concomitantly, the variety and arrangement thereof being limited only by the size of the means provided for operating the circuits; which will be positive in its operation, that is, the device is constructed to positively actuate the circuit closing instrumentalities at predetermined points corresponding to predetermined degrees of pressure or the like and when the action is started or the desired point reached, there will be a quick and positive throw of the circuit closing means from one position to another and a positive locking at the limit of its throw in either direction; wherein there may be a manual actuation of the circuit closing device no matter what position the circuit closing devices may be in under the influence of the automatic actuating means; wherein many adjustments are provided between the operating connections and the circuit closing mechanism; and in a word wherein a device having few mechanical parts easily assembled and dismounted, can be compactly set within a casing in such a way as to be free from dust, moisture, or tampering, and which will operate without sparking or combustion in any atmosphere.

Other objects and advantages will in part be apparent, and in part, be brought out more fully in the description which follows.

In the accompanying drawings there is set forth an embodiment of the invention showing its general principles in a simple form of application. In these drawings the following views are shown:

Figure 1 is a view in front elevation of an embodiment of the invention shown in connection with a pressure actuating device or prime mover in the form of a Bourdon tube;

Fig. 2, is a fragmentary detail view of a portion of the device which automatically throws the circuit controlling mechanisms from one position to another, and shows this mechanism locked in one of its positions;

Fig. 3, is a similar view showing the parts locked in the limit of their movement in the opposite direction;

Fig. 4, is a view in vertical section on line 4—4 of Fig. 1;

Fig. 5, is a fragmentary view in end elevation, of the parts shown in Fig. 3, and viewed from the left hand side of this figure;

Fig. 6, is a similar view seen from the right;

Figs. 7 and 8, are fragmentary detail views of a slightly modified form of automatic circuit control actuating mechanism and showing two positions thereof;

Fig. 9, is a similar view showing a slightly modified form of connecting the circuit control mechanism to a prime mover;

Fig. 10, is a fragmentary detail view showing a means for adjusting the entire movement with relation to the casing within which it is housed; and

Fig. 11, is a view in end elevation of the parts shown in Fig. 10.

In these views 1 designates a casing of the gauge type, having a threaded connection for association with a source of pressure and in communication with a pressure responsive device 2, here shown as a Bourdon tube. This or any suitable actuating means, is utilized as a prime mover to actuate the circuit closing devices.

The circuit controlling device comprises a back plate 3, and front plate 4 spaced apart therefrom by suitable posts 5. Upon and between these plates there is mounted the movement which operates the circuit closing and opening instrumentality. The back plate 3 is secured to the casing by means of screws 6, the heads of which engage a portion of the casing and the shanks of which work in slots 7 provided in the casing. An eccentric 8 passing through the casing and pivotally secured to the back plate is operable through a head 9 on

side of the casing to shift the back plate with relation to the casing when the screws are loosened and the screws are utilized, when tightened, to lock the back plate in adjusted position when so shifted. This movement permits adjustment of the entire circuit control operating mechanism bodily with relation to either the Bourbon or other operating means with which it may be associated and constitutes a means of adjusting the point where actuation will be accomplished.

Carried by a pivot member 10 which has bearings in the top and back plates, there is a lever 11. It is slotted as at 12 to provide an adjustment for the point of attachment thereto of a link 13, for instance as shown in Fig. 1. This link is secured at one end to the Bourdon or other actuating mechanism, and at its other end has a slotted connection with slot 12 in lever 11, through a bolt or the like 14. This permits shifting the point of pull on lever 11 and consequently the sweep of its free end. Between the pivot member 10 and the free end of lever 11, there are spaced apart bars 15, pivotally secured to lever 11, at pivot point or fulcrum 10', the lever extending between them. At the other end of these bars, there is mounted between them a roller 16 which tracks on angular or sloping, converging surfaces 17 and 18 of a circuit control carrier bar 19. This bar is mounted on a pivot bearing 20, intermediate the ends of the bar, the pivot having bearings in the top and back plates. The roller is normally held in engagement with the sloping surfaces of the bar by a spring 21 secured at one end to one of the posts 5 and at its other end to a hook 22 pivotally disposed between bars 15 intermediate their ends. It will be seen that spaced apart bars 15 and the roller 16 constitute a lever of the second class, the fulcrum of which is shiftable by movement of lever 11. When it moves beyond the apex of the triangle or point formed on bar 19 by the sloping surfaces 17 and 18 of the bar, it causes swinging of the bar 19 on its pivot, the movement being limited by stops 23, placed to engage one of the posts 5 as best seen in Figs. 2 and 3.

Upon bar 19 there is mounted a circuit controller carrying clamp or member 24. It is shown in Fig. 4, as carrying a single closed tube 25 having therein the terminals 26 of two circuits, disposed at opposite ends of the tube, and closed or opened depending upon the position of a drop of mercury or the like 27. An inert gas fills the tube and prevents sparking, while terminals 26 are sealed therein. Wires 28 carry current from binding posts 29 suitably mounted on the casing, to terminals 26. By changing the position of terminals 26 within the tube and the number of tubes carried by the clamp 24, a large variety of circuit closing arrangements may be effected. It will be seen from a view of Figs. 1 to 3 that when the tube is tilted to the position shown in Fig. 1, that the circuit at the left of the figure will be closed and the other opened. When the parts are in the position shown in Fig. 3, the operation is just the reverse and is accomplished by link 13 pulling on the lower part of lever 11 shifts pivot point or fulcrum 10' of spaced bars 15, causing roller 16 to ride down the sloping portion 17 of carrier bar 19. When the roller has passed the apex or point where these sloping surfaces meet, it will force or tilt the bar 19 to the position shown in Fig. 3. There is a double action effected here as the spring causes a quick motion of the roller down the slopes in either direction and this is utilized to quickly swing the bar to the limit of its movement until either of the stops 23 engage post 5, the roller holding securely in that position until shifting of fulcrum 10' again causes tilting of the bar 19.

In addition to this automatic actuation of the circuit controlling devices there is provided a hand actuation which may be operated at any position of the automatic means. As here shown this includes a hand set 30 passing from outside the casing and carrying on its inner end a swinging stub of lever 31. Rotation of hand set 30 causes this swinging lever to engage either of the opposite sides of a post 32 attached to lever 11 in the path of travel of the swinging lever 31. As seen in Figs. 2 and 3, if the swinging lever is rotated clockwise in Fig. 2, it will engage post 32 and swing lever 11 on its pivot 10, causing the roller 16 to move downwardly along sloping surface 17 until it has passed the point or apex, when the parts will assume the position shown in Fig. 3. Here the swinging lever 31 is shown in the opposite position and movement in a counter clockwise direction will produce the opposite result. This hand setting provides a switch which can be operated without danger of sparking in atmospheres where inflammable gases are prevalent and also permits quick and positive actuation of the circuit control at any and all points of its automatic movement.

A slightly modified form of construction is shown in Figs. 7 and 8. Here the carrier bar 19 carries an extension 33 which is connected by a link 34 to a circuit control carrier 35, the latter being pivotally mounted for swinging movement on a pivot bar 36. The provision of the link connection with a swinging carrier for the circuit closing device permits a larger and quicker swing or tilt of the carrier and consequently of the circuit closing tube which may be mounted thereon.

In Fig 9, there is shown a form of connecting the circuit closing mechanism with a pressure actuated device of any description but especially where there is little movement of the prime mover, but a fair amount of power. In this instance instead of link 13

being attached directly to the Bourdon or other actuating means, it is attached to one end of a bar 37, the other end of which is secured pivotally to one of the plates of the movement. Intermediate this bar there are provided holes 38 or a slot, shown in dotted lines to constitute means for adjusting the degree of force and the manner of application from a link 39 which is adapted to be secured to the prime mover.

The device constitutes a simple and practical means for accomplishing the objects set forth and while it has been described in connection with the embodiment herein illustrated, it will be understood that various changes in the structure and arrangement of the parts are contemplated as being within the scope of the invention as set forth in the claims.

What I claim is:

1. A circuit controller comprising a liquid contact circuit opening and closing device; means for movably supporting it including a carrier; mechanism operatively associated with the circuit opening and closing device including a spring actuated arm having sliding engagement therewith for quickly moving it from one position to another and holding the carrier at the limits of its movement; and including an instrumentality permitting a partial movement of the moving mechanism in both directions without actuating the circuit controlling device.

2. A circuit controller comprising a liquid contact circuit opening and closing device; means for movably supporting it including a carrier member; mechanism operatively associated with the circuit opening and closing device including a spring actuated arm having sliding engagement therewith for quickly moving it from one position to another and holding the carrier at the limits of its movement; and including an instrumentality permitting a partial movement of the moving mechanism in either direction without actuating the circuit controlling device; and stops on the carrier member, and a fixed member coacting therewith for limiting movements of the circuit opening and closing device.

3. A circuit controller comprising a liquid contact circuit closing and opening device; means for movably supporting it, including a carrier member; mechanism for moving the supporting member, including a spring actuated arm having sliding engagement therewith and an actuating member movable with relation to the supporting member for a predetermined distance in either direction without effecting actuation of the carrier, and further operable to positively move the carrier and holding the carrier at the limits of its movement including stops on the carrier and a fixed member coacting with said stops.

4. A circuit controller comprising a liquid contact circuit closing and opening instrumentality; means for movably supporting it, including a carrier-member having stops and sloping surfaces; a fixed member adapted to be engaged by a stop, an actuating member having a portion adapted to engage and slide over one sloping surface of the carrier for a predetermined distance and engage one stop with the fixed member; mechanism for moving the carrier after the actuating member has traveled a predetermined distance, said mechanism including a spring member operatively associated with the actuating member while it is sliding upon the sloping surface of the carrier member to build up a spring tension; and means upon the carrier including the other sloping surface for quickly applying this spring tension to the carrier to move it from one position to another disengaging the said stop and engage the other stop.

5. A pressure actuated circuit controller comprising a liquid contact circuit closing and opening instrumentality; means for movably supporting it including a carrier; an actuating member operatively associated with the supporting means; mechanism permitting a predetermined movement of the actuating member in both directions without moving the supporting means including a spring actuated arm having sliding engagement with said supporting means; means for positively moving the carrier and holding the carrier at the limits of its movement operatively associated with the supporting means and actuating member; a pressure responsive instrumentality; and mechanism connecting the pressure responsive instrumentality with the actuating member.

6. A pressure actuated circuit controller comprising a liquid contact circuit closing and opening instrumentality; means for movably supporting it including a carrier; an actuating member operatively associated with the supporting means; mechanism permitting a predetermined movement of the actuating member without moving the supporting means; means for positively moving the carrier and holding the carrier at the limits of its movement operatively associated with the supporting means and actuating member; a pressure responsive instrumentality; mechanism connecting the pressure responsive instrumentality with the actuating member; said mechanism including a lever; and a link member adjustably attached to the lever, and also connected with the pressure responsive instrumentality.

7. A pressure actuated circuit controller comprising a liquid contact circuit closing and opening instrumentality; means for movably supporting it including a carrier; an actuating member operatively associated with the supporting means; mechanism permitting a predetermined movement of the actuating

member without moving the supporting means; means for positively moving the carrier and holding the carrier at the limits of its movement operatively associated with the supporting means, and actuating member; a pressure responsive instrumentality; mechanism connecting the pressure responsive instrumentality with the actuating member; a casing within which the supporting means and actuating member are mounted; and mechanism for moving certain of these elements bodily with relation to the pressure responsive instrumentality whereby the point of actuation of the carrier may be varied.

8. A pressure actuated circuit controller comprising a liquid contact circuit closing and opening instrumentality; means for movably supporting it including a carrier; an actuating member operatively associated with the supporting means, mechanism permitting a predetermined movement of the actuating member without moving the supporting means including a spring actuated arm having sliding engagement with said supporting means; means for positively moving the carrier operatively associated with the supporting means and actuating member; a pressure responsive instrumentality; associated mechanism connecting the pressure responsive instrumentality with the actuating member; and mechanism for positively moving the supporting means independently of the pressure responsive instrumentality.

9. A circuit controlling device comprising a circuit closing and opening instrumentality; a movable carrier to which the circuit closing and opening instrumentality is adapted to be secured; a lever operably associated with the movable carrier and adapted to hold the carrier in a predetermined position; means for shifting the position of the lever, said means including a second lever connected with the first lever; means for connecting the second lever with a prime mover, manual means for actuating the carrier, said means including a swinging lever member; and a member on one of the levers in the path of travel of the swinging member and actuable thereby to move the carrier to the limits of its movement in either direction.

10. A circuit controller comprising a mercury tube switch, means for movably supporting the tube including a carrier member having a plurality of stops and sloping surfaces, means coacting with said stops to limit the movement of the carrier, an actuating member having a portion adapted to engage and slide over a sloping surface of the carrier for a predetermined distance holding one carrier stop at the limit of its movement, and mechanism for moving the carrier after the actuating member has traveled a predetermined distance by engaging another sloping surface and holding another carrier stop at the limit of its movement.

11. A circuit controller comprising a mercury tube switch, means for movably supporting the tube including a carrier member having sloping surfaces, an actuating member having a portion adapted to engage and slide over the carrier for a predetermined distance, mechanism for moving the carrier after the actuating member has traveled a predetermined distance by engaging another sloping surface, and mechanism for limiting the movement of the carrier operatively associated therewith including a plurality of stops upon the carrier.

12. A circuit controller comprising a mercury tube switch, means for normally supporting the tube including a carrier member having a plurality of stops and sloping surfaces, means coacting with the stops to limit the movements of the carrier, an actuating member having a portion adapted to engage and slide over a sloping surface of the carrier for a predetermined distance coacting with a stop to maintain the carrier at the limit of its movement in one direction, mechanism for moving the carrier after the actuating member has traveled a predetermined distance by engaging another sloping surface and holding another carrier stop at the limit of its movement in the opposite direction, said mechanism including a spring member operatively associated with the actuating member.

13. A circuit controller comprising a mercury tube switch, means for movably supporting the tube including a carrier member having a plurality of stops and sloping surfaces, means coacting with the stops to limit the movements of the carrier, an actuating member having a portion adapted to engage and slide over a sloping surface of the carrier for a predetermined distance coacting with a stop to hold the carrier at one limit of its movement, mechanism for moving the carrier after the actuating member has traveled a predetermined distance by engaging another sloping surface coacting with another stop to hold the carrier at the other limit of its movement, said mechanism including a spring member operatively associated with the actuating member while sliding upon the sloping surface of the carrier member to build up a spring tension, and mechanism for quickly applying this spring tension to the carrier to move it from one position to another.

14. In a pressure actuated circuit controller, an expansible and contractable member, an operating member connected to said expansible and contractable member, an actuating member carried thereon, a pivoted carrying member supporting a mercury tube switch thereon and having a plurality of stops and sloping surfaces adapted to be alternately engaged by the actuating member to rotate the carrier member about its pivot, means adapted to be alternately engaged by said

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stops to limit the rotation of the carrying member, a spring holding the actuating member in engagement with the carrier, whereby movement of the expansible and contractable member in one direction causes the operating and actuating member carried thereon to engage one sloping surface to tilt the mercury tube in one direction to engage one stop and movement of the expansible and contractable member in the opposite direction causes the operating member and actuating member carried thereon to engage the other sloping surface and tilt the mercury tube in the opposite direction to engage the other stop.

15. The combination of a liquid contact circuit controlling device having the contacts therefor enclosed in a sealed tube, a carrier therefor including a plate mounted for oscillatory movement provided with a member having two stops and two angular surfaces extending therefrom, means coacting with said stops to limit the oscillation of the carrier plate, a spring actuated member adapted to alternately engage said angular surfaces to oscillate the plate to alternately engage and disengage said stops, and means to operate said spring actuated member to travel over said surfaces.

16. In combination, a pressure actuated circuit controller comprising a pressure responsive means, a tilting mercury tube switch, a carrier therefor, means to maintain the switch in either open or closed position, and a quick throw mechanism acting in response to predetermined changes in pressure to tilt the switch from one predetermined position to the other, together with hand operated means for restoring the switch to its first position.

17. In combination, a pressure actuated circuit controller comprising a pressure responsive means, one or more liquid contact switches, a tiltable carrier therefor, means to maintain the switches in open or closed position, and a throw over mechanism acting in response to predetermined changes in pressure to tilt the switches from one position to the other, hand operated means to restore the switches to the first position, and means for adjusting the pressures at which said switches are operated to make or break the circuits controlled thereby.

In testimony whereof I affix my signature.

IRA E. McCABE.

798 June 10, 1930. I. E. McCABE 1,762,183

THERMOSTATICALLY ACTUATED ELECTRIC SWITCH

Filed Oct. 10, 1928 2 Sheets-Sheet 1

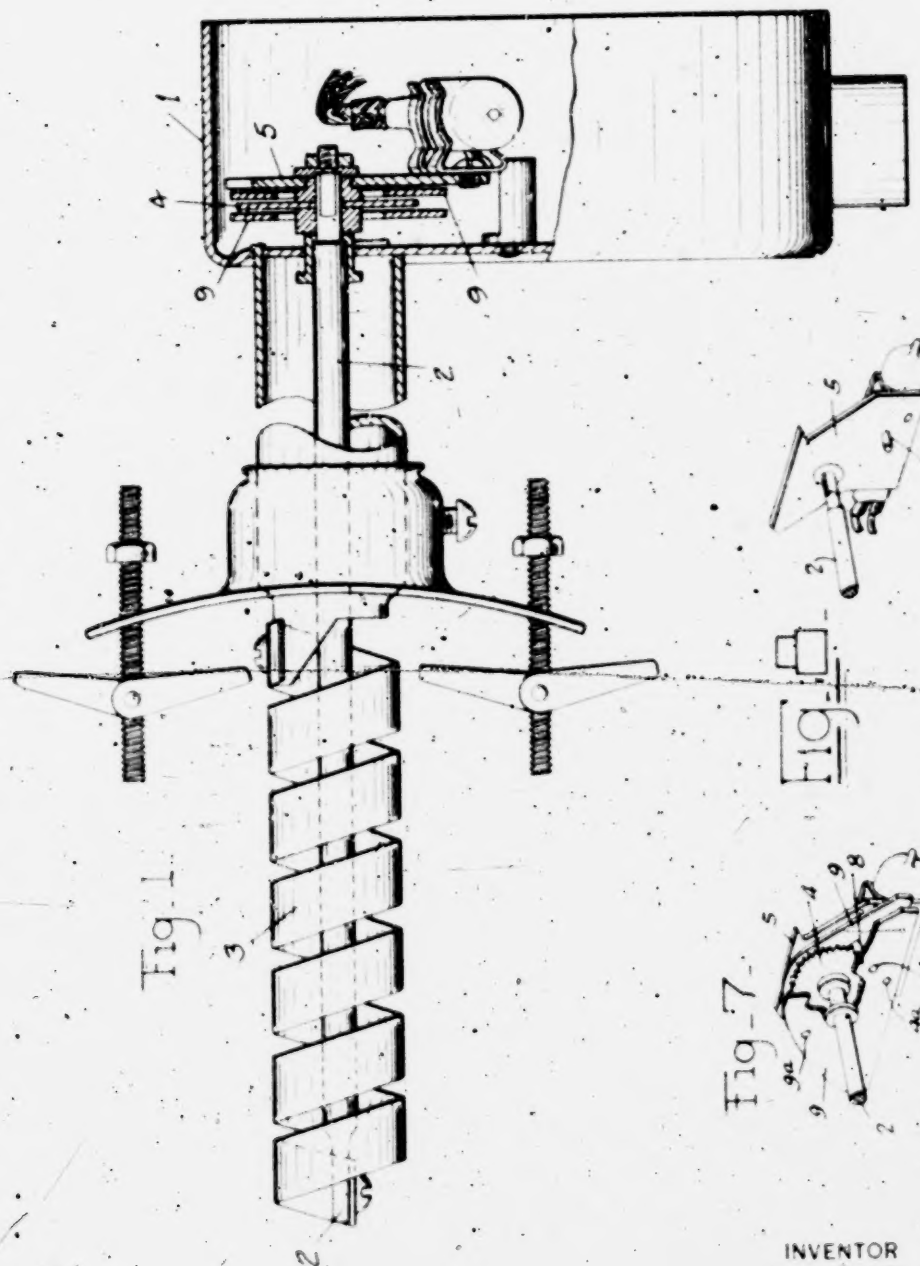


Fig. 1

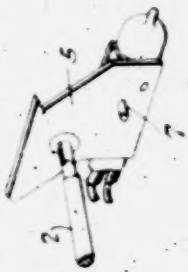


Fig. 6

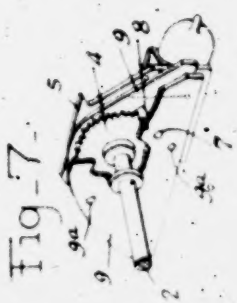


Fig. 7

INVENTOR
IRA E. McCABE
BY Langdon Morris
ATTORNEY

THERMOSTATICALLY ACTUATED ELECTRIC SWITCH

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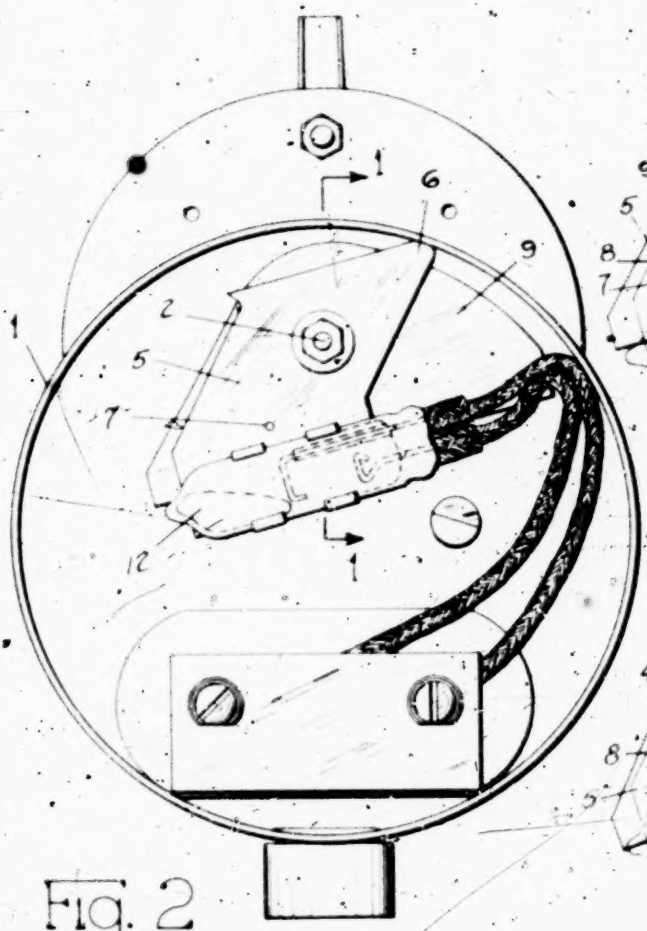


Fig. 2

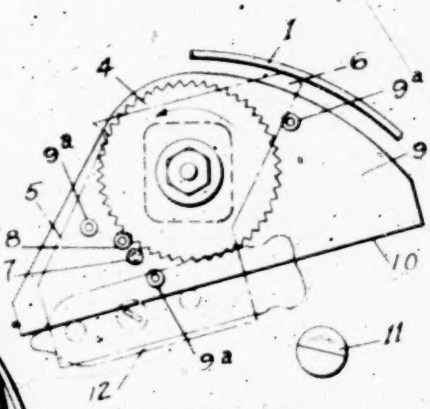


Fig. 3

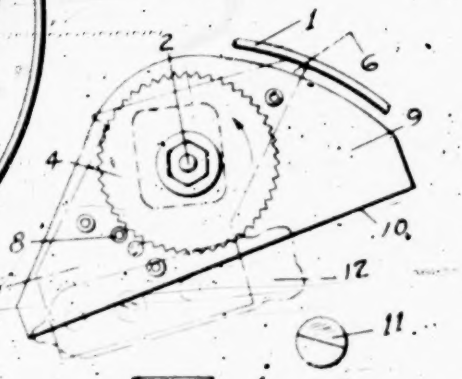


Fig. 4

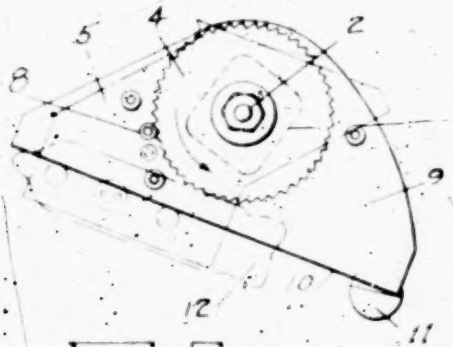


Fig. 5

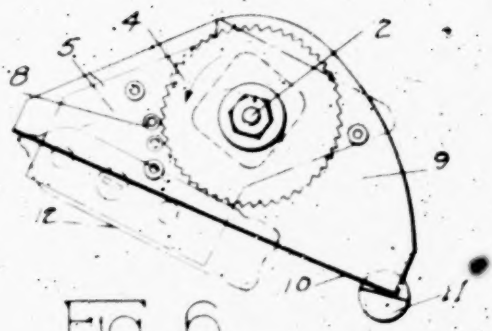


Fig. 6

INVENTOR
IRA E. McCABE
BY Rayden Mom
ATTORN

Patented June 10, 1930 1,762,183

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# UNITED STATES PATENT OFFICE

IRA E. McCABE, OF CHICAGO, ILLINOIS

## THERMOSTATICALLY-ACTUATED ELECTRIC SWITCH

Application filed October 10, 1928. Serial No. 311,436.

This invention relates to thermostatically actuated electric switches and more particularly to a switch of this character so constructed that the expansion or contraction of the thermostatically actuated member will upon movement in either direction, irrespective of its condition, immediately throw the switch and then may expand or contract to a greater degree freely and irrespectively of the position of the switch mechanism.

With these and other objects in view, reference is made to the accompanying sheet of drawing illustrating a preferred embodiment of this invention with the understanding that minor detail changes may be made without departing from the scope thereof.

In the drawings:

Figure 1 is a view in side elevation of an embodiment of this invention as applied to a stack control switch employed in an electrically operated domestic liquid fuel heating system, with parts broken away.

Figure 2 is a view in front elevation of Figure 1.

Figure 3 is a fragmentary detail view with the switch carrier plate removed, indicated in dot and dash lines, illustrating the normal relation of the parts assumed when the actuating member has reached the normal limit of its travel.

Figure 4 is a similar view illustrating the relation of the parts assumed as the actuating member continues movement in the same direction.

Figure 5 is a similar view illustrating the normal relation of the parts when the actuating member has reached the normal limit of its travel in the reverse direction.

Figure 6 is a similar view illustrating the relation of the parts assumed as the actuating member continues movement in that direction.

Figure 7 is a detailed fragmentary view in perspective of the assembled actuating parts.

Figure 8 is a similar view of the switch carrier plate.

In electrically operated domestic heating plants an electric motor is employed to supply the fuel to the furnace or heater as required and in such systems a safety device is customarily placed in the motor circuit, or arranged to control the motor circuit, which safety device is in the form of a thermostatically actuated electric switch responsive to combustion condition. This type of switch is shown and described herein to illustrate one embodiment of this invention, although the same mechanism with but minor changes, may be applied to any other use wherein a change of temperature is desired to control the closing or opening of an electric circuit, such as electrically operated refrigerating machines.

Referring to the embodiment illustrated, the switch and switch operating mechanism is enclosed in a cylindrical casing 1, which casing supports in the usual manner a rotatable shaft 2 and thermostatic coil 3 of bi-metallic metal adapted to be inserted and held within the stack of an oil burning furnace in the usual manner. Since the so called stack safety for controlling the motor circuit of a liquid fuel heating system is an old and well known commercial device, no further description is deemed necessary beyond the statement that one end of the thermostatic coil 3 is held stationary and the other secured to the free end of the shaft is rotated first in one direction and then in the reverse direction.

The end of the shaft 2 enters within the casing 1 and non-rotatably mounts a disc or wheel 4, which may be keyed to the shaft in any preferred manner, and the end of the shaft also rotatably mounts a switch carrier plate 5 which may be held against longitudinal movement therein in any desired manner so that the rotation of the flat surfaces of the disc or wheel 4 and carrier plate re-

main parallel. The carrier plate preferably is of such dimensions that one of its upper corners 6 engages the side walls of the casing and limits its rotation about the shaft in one direction. Below the center of the shaft 2 and at one side of the disc or wheel 4 the plate 5 engages by pivot pin 7 two correspondingly shaped spaced apart plates 9 each having an enlarged opening of greater size than the shaft 2 which passes therethrough and which allows movement of said plates 9 about the pivot 7. A roller 8 adapted to engage and travel over the circumference of the disc or wheel 4 is mounted between the plates 9 and is maintained in contact therewith by the weight of the plates 5 and 9 which extend beyond.

It is preferable to construct this carrier plate 5 as shown in Figure 1, having the upper right hand portion 6 above the shaft 2 extended to engage the casing wall to limit rotation in that direction, with the body of the plate extended below and to the left of shaft 2 so that when free to rotate about shaft 2 the plate will normally swing about shaft 2 until the portion 6 engages the casing.

The plates 9 are somewhat triangular shaped and the longest side or base arranged at the bottom and the shaft opening arranged substantially above the center thereof. The plates are preferably held together in spaced apart relation by spacing members 9a secured thereto and by being pivoted to the carrier plate 5 below and at one side of the shaft 2 and being cut away about the shaft, the plates are capable of a certain amount of free movement about the pivot 7.

The disc or wheel 4 is provided with a series of peripheral teeth so that the weight of the portion of the plates 9 on the other side of the shaft 2 will normally hold the roller in contact with the body of disc or wheel between the apices of two adjacent teeth, and upon rotation of the shaft 2 in one direction the disc or wheel 4 will rotate therewith and roller 8 carried between the plates 9 will through the contacting relation to the toothed surface of the disc and connection of the pivot 7 to the carrier plate 5 impart a rotation movement to said plate in the same direction as the rotation of the shaft until the corner 6 of the plate 5 engages the side wall of the casing and when this occurs the plate will remain stationary and continued rotation of the shaft 2 in the same direction forces the roller 8 outward against the weight of plates 9 causing it to continue to ride over the apices of the toothed surface of the disc as long as rotation in that direction continues and when rotation of the shaft 2 ceases the roller contact will maintain the plate stationary but immediately upon reverse rotation of the shaft the roller connection will impart a reverse rotation to the plate 5 until the under side 10 of the plates 9 engage a stop 11 upon the casing wall and continued reverse rotation of the shaft 2 will maintain the carrier plate 5 stationary as long as the toothed surface of the disc continues to pass below the roller 8.

The switch carrier plate 5 is provided with a mounting for a mercury tube switch 12 which switch is connected in the motor circuit, or circuit controlling the motor circuit, so arranged that when the plate 5 is rotated in one direction about the shaft 2 the mercury tube switch 12 is tilted to close the circuit therethrough and when the plate 5 is rotated in reverse direction the mercury tube switch 12 is tilted to open said circuit.

The mercury tube switch 12 is shown in Figure 1 as being supported at the bottom of plate 5 below the shaft 2 in such a position that if plate 5 is free to rotate about shaft 2 the weight thereof will swing the plate to tilt the switch to open the circuit therethrough. Should the safety feature depend upon the closing of circuit, the switch 12 will be attached to plate 5 in reverse to the position shown in Figure 1. The pivotal connection of the plates 9, with the enlarged openings about shaft 2, to plate 5 allows of any desired adjustment for the normal position of switch 12 to be made by hand when the instrument is installed. The shape of plates 9 and 5 with their main bodies below the shaft 2 and their pivotal connection to each other below and to the left of shaft 2 normally tends to rotate the plate 5 in the direction to bring its extension 6 in contact with the side of the casing wall, as shown in Figure 1. Therefore, should for any reason the shaft become detached from the thermostatic coil 3, such as the heat to which the coil is subjected during the employment of the device burn to consume the coil, the shaft 2 is free to rotate and allow plate 5 with its gravity connection with disc 4 to assume its normal position.

The above described weight actuated or gravity connection between the shaft 2 and switch carrier plate 12 produces a positive switch operating mechanism actuated by the expansion and contraction of the thermal element 3, the sensitiveness of which depends upon the number and character of the teeth upon the circumferential surface of the disc 4, and at the same time allows an unrestrained amount of expansion and contraction of the thermal element 3 to rotate the shaft 2 beyond that required to tilt the mercury tube switch to open and close the circuit therethrough.

Those skilled in this art will appreciate the advantage of allowing unrestricted expansion and contraction of a coil of bimetallic metal constantly subjected to changes in temperature to which it is responsive.

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Likewise, the efficiency of this device is obvious, as well as its greater length of the operating life both of which characteristics are desirable and indeed most necessary to a safety device of this general type. It is also obvious that this invention can readily be applied to any other type of thermostatically operated electric switches, such as a room thermostat for controlling an electric circuit for operating dampers of a coal furnace or the motor of a liquid fuel burning system or similar devices in which the thermostatic element in expanding and contracting causes the rotation of a shaft, sleeve or other member to actuate a mercury tube switch. It is to be noted that in this device that the absence of springs or other devices which will deteriorate with age and use is conspicuous, and should the heat to which the thermostatic element is subjected be sufficient to burn or consume the same the gravity actuated roller will automatically return the switch to the off position on account of the excess weight upon the roller when the switch is in the closed position.

What I claim is:

1. A temperature responsive electric switch having a temperature responsive element the movement of which is adapted to actuate a switch operating mechanism including a rotatable member actuated by said element, a rotatable switch carrier mounted thereon, a mercury tube switch mounted upon said carrier, said rotatable member provided with a toothed track, said switch carrier pivotally connected to a gravity actuated member, said member mounting a roller adapted to travel over said track, and said gravity actuated member acting upon said roller to hold it in contact with said track, whereby upon rotation of the rotatable member in either direction imparts a rotation movement to the carrier plate.

2. A temperature responsive electric switch having a temperature responsive element the movement of which is adapted to actuate a switch operating mechanism including a rotatable member actuated by said element, a rotatable switch carrier mounted thereon, a mercury tube switch mounted upon said carrier, said rotatable member provided with a toothed track, said switch carrier pivotally connected to a gravity actuated member, said member mounting a roller adapted to travel over said track, said gravity actuated member acting upon said roller to hold it in contact with said track, whereby upon rotation of the rotatable member in either direction imparts a rotation movement to the carrier plate, means for limiting the rotation of the carrier plate, said roller connection allowing further rotation movement of the rotatable member after the movement of the carrier plate has reached its limit.

3. In a device of the character described, a casing, an expansible and contractable element mounted thereon, a shaft rotatably mounted in the casing, adapted to be rotated in one direction as said member expands and in the reverse direction as said member contracts, a disc rigidly secured to said shaft having a toothed track about its periphery, a pivoted switch carrier plate rotatably mounted upon said shaft having a projection adapted to engage the casing to limit its rotation in one direction, an electric mercury tube switch mounted upon said plate, a roller carrier plate pivotally connected to said plate, a roller mounted adjacent said roller carrier plate pivot to be received between the teeth of the track, the weight on the other extremity of the roller carrier plate, adapted to normally position the roller between teeth of the track, whereby rotation of the shaft in one direction initially rotates the carrier plate in the same direction and upon the plate engaging the casing continued rotation of the shaft in the same direction causes the undulate track to travel under the roller and initial movement in reverse rotation of the shaft simultaneously imparts initial reverse rotation to the carrier plate.

4. A temperature responsive electric switch operating mechanism, including a mercury tube electric switch, a movable member, a toothed track thereon, a pivoted carrier plate for the mercury tube rotatably mounted upon the movable member, a gravity actuated support pivotally connected to said carrier plate, a roller mounted on said support adapted to travel over said track, and an expansible and contractible member adapted to impart movement to said movable member.

5. A temperature responsive electric switch operating mechanism including a mercury tube electric switch, a movable member, a toothed track thereon, a pivoted carrier plate for the mercury tube rotatably mounted upon the movable member, a gravity actuated support pivotally connected to said carrier plate, a roller mounted thereon adapted to travel over said track, and an expansible and contractible member adapted to impart movement to said movable member, means for limiting the rotation of the carrier plate, said roller connection allowing further rotative movement of the rotatable member after the movement of the carrier plate has reached its limit.

6. A temperature responsive electric switch operating mechanism including a mercury tube switch, a movable member, a toothed track thereon, a pivoted carrier plate for the mercury tube rotatably mounted upon the movable member, a gravity actuated support, pivotally connected to said carrier plate, means thereon engaging said

8[illegible]ched track, and an expansible and contractible member adapted to impart movement to said rotatable member, means for limiting the rotation of the carrier plate, said connecting means allowing further rotative movement of the rotatable member after the movement of the carrier plate has reached its limit, said gravity actuated support returning the switch to open position upon the consumption of the expansible member by the heat to which it is subjected.

IRA E. McCABE.

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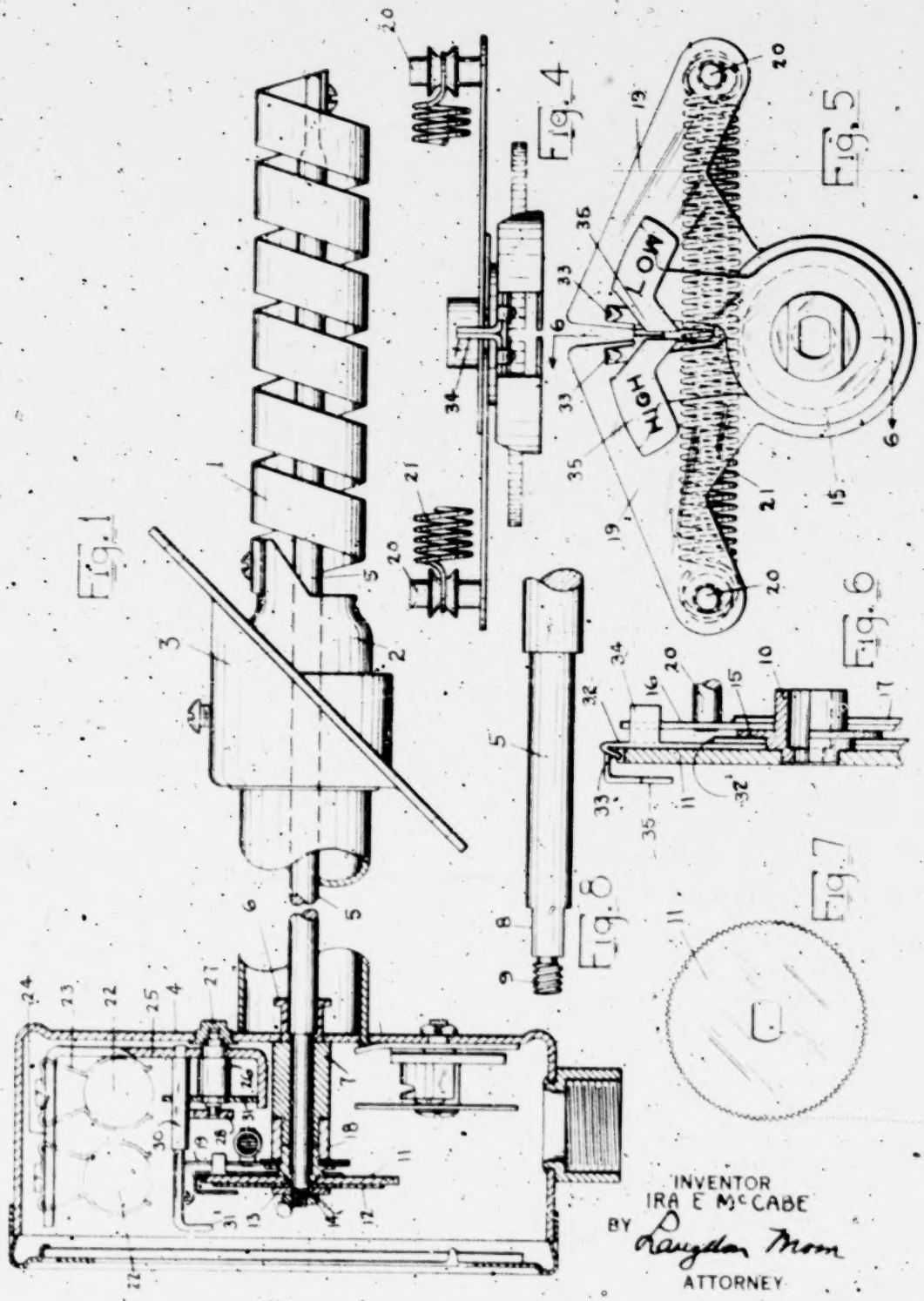
Dec. 1, 1931. I. E. McCABE 1,834,288

ELECTRIC SWITCH MECHANISM

Filed Aug. 5, 1929 2 Sheets-Sheet 1

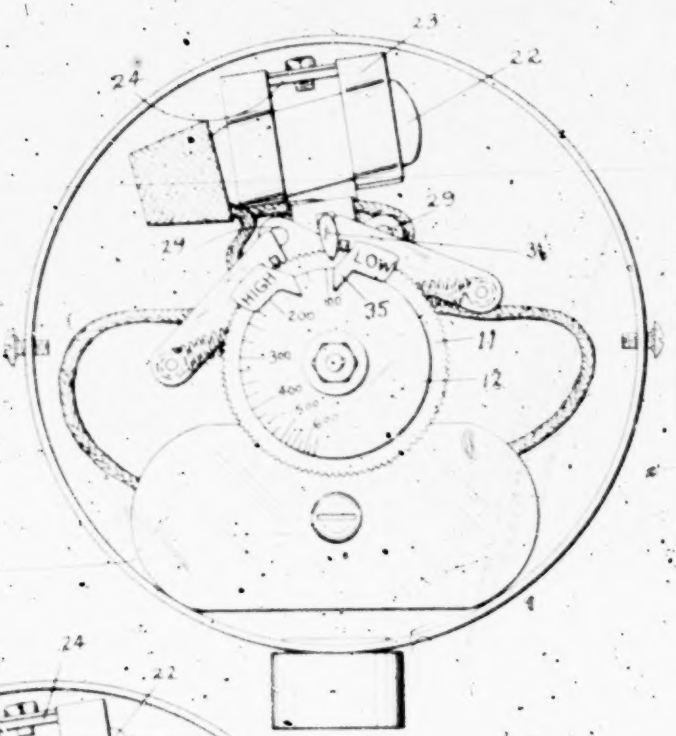



INVENTOR
IRA E McCABE
BY Langdon Morris
ATTORNEY

ELECTRIC SWITCH MECHANISM

Filed Aug. 5, 1929 2 Sheets-Sheet 2

Fig 2



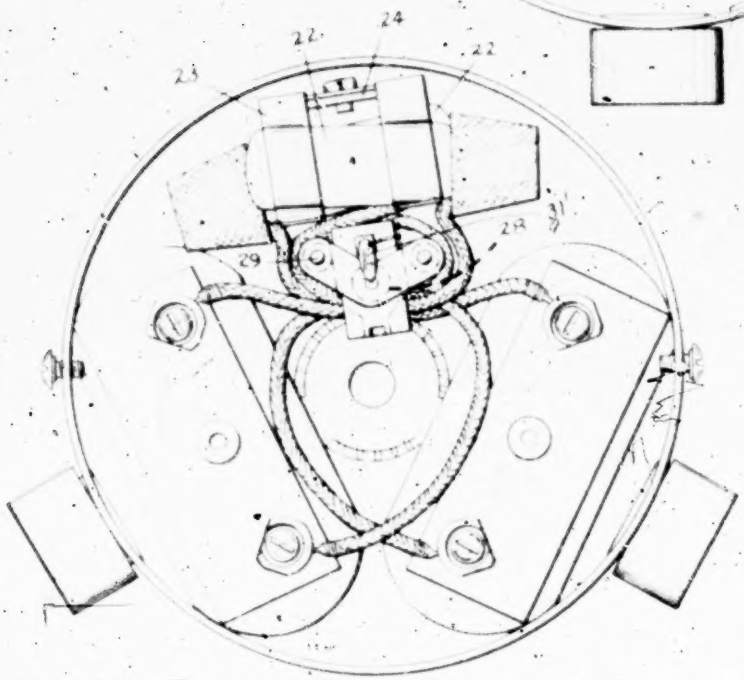




Fig 3

INVENTOR
IRA E. McCABE
BY
Laighton Mann
ATTORNEY.

Patented Dec. 1, 1931

1,834,288

# UNITED STATES PATENT OFFICE

IRA E. McCABE, OF CHICAGO, ILLINOIS

## ELECTRIC SWITCH MECHANISM

Application filed August 5, 1929. Serial No. 383,568.

This invention relates to improvements in electric switch mechanism and in particular to an electric switch mechanism which is responsive to temperature changes.

It is an object of this invention to provide a device of this character which is actuated by changes in temperature to make and break an electric circuit, and is advantageously employed as a safety device in electrically operated oil burning heating systems. The purpose of this device is to break the motor circuit of the oil burner and thereby discontinue the combustion in the furnace or heater when the temperature of the combustion reaches a degree which is dangerous to the furnace or heater. In order to produce a device of this kind which will be readily adapted to various types and sizes of heaters in which the degrees of heat produced by the combustion without endangering the furnace or heater may vary, in accordance with the respective types or sizes, it is necessary that the device be adjustable, and further desirable to have at hand indicating means showing the actual temperature of the furnace or heater in which the device is installed. It is another object of this invention to provide a safety device of this character which may be set on the job to break the motor circuit when the degree of temperature dangerous to the particular type or size of heater or furnace is approached.

This invention provides means for indicating the actual temperatures of the furnace and means for indicating the temperature at which the control will operate to make or break the circuits, together with means for quickly and conveniently adjusting the instrument to operate at the desired temperatures.

With these and other objects in view reference is made to the accompanying sheets of drawings which illustrate a preferred form of this invention with the understanding that minor detail changes may be made therein without departing from the scope thereof.

In the drawings:

Figure 1 is a view partly in side elevation and partly in vertical central longitudinal section illustrating the application of this invention with the mercury tube switches omitted.

Figure 2 is a view in end elevation of Figure 1 with the cover of the switch mechanism casing removed, illustrating the use of a single mercury tube switch.

Figure 3 is a view similar to Figure 2, illustrating the application of two mercury tube switches, and with the operating shaft and mechanism carrier thereby omitted.

Figure 4 is an enlarged detailed top plan view, with parts broken away, of the adjusting mechanism.

Figure 5 is a view in front elevation of Figure 4.

Figure 6 is a fragmentary detailed view in section taken on the line 6—6 Figure 5.

Figure 7 is a detailed view in front elevation of the toothed disc shown in Figures 1 and 2.

Figure 8 is an enlarged detailed view of that end of the operating shaft which mounts the operating mechanism.

In the embodiment of this invention illustrated upon the accompanying drawings, the thermostatic element is illustrated as a helical coil 1 of bi-metallic material, one end of which is secured to a housing 2 adapted to be inserted through the duct or casing of a furnace or heater employing an electrically controlled oil burner mechanism. The housing 2 is preferably held in position in the hot air duct or casing by an adjustable clamping member 3 and it is preferable to extend the housing through this member to engage the rear wall of the switch mechanism casing 4. The other end of the helical coil 1 is rigidly secured to an operating shaft 5 which passes through a bearing 6 in the rear wall of the casing 4, the shaft passing through this bearing also passes through a shouldered spacing member 7. The end of the shaft 5 terminating within the casing 4 is provided with oppositely disposed parallel flat cut-away surfaces 8, as shown in Figure 8, and at this extremity is screw threaded, as at 9. A flanged sleeve 10 is keyed upon the flat surfaced portion of the shaft 5 and a toothed disc 11 is keyed upon the sleeve 10, as shown in Figure

6. A disc 12, of less diameter than the disc 11, is preferably mounted on the end of the shaft 5 and held in engagement with the disc 11 by a washer 13 and nut 14 upon the screw threaded portion 9 of the shaft 5. The flanged sleeve 10 engages the spacing member 7 and is provided with an outstanding circular flange 15. Two plates 16 and 17 are rotatively mounted upon the sleeve 10 and are held against the flange 15 by a sleeve 18 interposed between said plates and the shoulder of the spacing member 7. The plates 16 and 17 are each provided with radial extensions 19, as shown in Figure 5, the extensions 19 of the plates 16 and 17 are provided with adjacent substantially radial edges with angular portions extending away therefrom. The ends of these angular portions opposite the respective radial edges are each provided with anchors 20 for engaging the opposite ends of a coil spring 21, the tension of which is sufficient to normally maintain the radial edges adjacent each other.

One or more mercury tube switches 22 are secured by clips 23 to a carrying arm 24 bent at right angles to a switch operating plate 25 which is pivotally mounted upon the pivot pin 26, mounted in the bearing 27 secured to the rear wall of the casing 4 and a bearing plate 28, held in spaced relation to the rear wall of the casing 4 by the posts 29, which also serve as stops limiting the movement of the operating plate 25 in either direction. An operating arm 30 is secured to the switch carrying plate 25 above its pivot 26 and held in parallel relation to said pivot by the plate 31 mounted thereon between the bearing plate 28 and switch carrier plate 25. The operating arm 30 extends beyond the bearing plate 28, passing over a cut-away portion thereof, and terminating in a downwardly extending finger or indicator 31 in advance of the toothed disc 11, said finger or indicator providing means of showing the actual temperature of the furnace or heater in which the device is installed.

The radial extensions 19 are of such proportions that the radial edges thereof may be brought into engagement with the switch operating arm 30. Between the toothed disc 11 and flange 15 two plates 32 and 32' are loosely mounted upon the sleeve 10. These plates are each provided with upwardly extending portions and each provided with bent down finger 33 adapted to engage in the teeth of the toothed disc 11, that portion of the plate directly below the toothed finger is provided with a bent back portion 34 adapted to pass between the radial edges of the extensions 19 of the plates 16 and 17, and that portion of the plate next above the finger is bent outwardly over the circumference of the toothed disc and then downwardly parallel to the surface of said disc and terminated in pointers 35, the edges of which are in line with the bent back portions 34 and each of these pointers are adapted to pass over the plate 12, as shown in Figure 2.

The fingers 33 are slidable over the toothed disc 11 and will normally hold the plates 32 and 32' of the fingers in contact with the toothed plate 11. The spring 21 of the radial extensions 19 of plates 16 and 17 will normally hold their respective radial edges against the backward extensions 34 of the finger carrying plates. The radial edges of the plates 19 upon rotation of the shaft 5 will, through the connection of the fingers 33 to the toothed disc 11 and portions 34, engage the switch operating arm 30 when the shaft 5 is rotated in one direction to move the arm 30 in that direction and tilt the switch carrying plate 28, thereby making or breaking, as the case may be, the circuit through the mercury tube 22, and when the shaft 5 is rotated in the opposite direction the radial extension 19 of the other plate will in the same manner engage the opposite side of the switch operating arm 30 and tilt the switch in the opposite direction. The fingers 33 may be manually moved to slide over the teeth of the disc 11 so that the relative relation of the radial edges of the plates 19 may be adjusted independently of each other and cause them to engage the opposite side of the switch operating shaft 30 as desired. The plate 12 on the outer side of the toothed disc 11 may be calibrated to display a temperature scale and, as seen in Figure 2, the pointers 35 are adapted to travel over such scale and by the proper manual adjustment of the fingers 33 upon the toothed disc 11 their respective radial extensions 19 may be so adjusted that the radial edges thereof upon rotation of the shaft 5 in one direction will engage the switch operating arm 30 and tilt the switch at a predetermined temperature and upon rotation in the opposite direction the other radial extension may be caused to engage the switch operating arm 30 at a predetermined temperature and tilt the switch in the opposite direction.

While Figure 2 illustrates a single mercury tube switch 22 it is obvious that two or more mercury tube switches might be supported as indicated in Figure 1. Figure 3 does illustrate two mercury tube switches mounted upon the switch carrying plate 25 tilted in one direction with a circuit closed in one switch and broken in the other, and it is obvious that when the switch carrying plate 25 is tilted in the opposite direction the closed circuit will be broken and the open circuit will be closed.

The fingers 33, while described as being slidable over the toothed disc 11 do not actually ride over the teeth of this disc but actually engage the teeth, when positioned, forming a lock between the finger carrying plates and toothed disc. The adjustment of the

fingers upon the toothed disc is performed by pressing the portion carrying the pointer 35 in the direction of the disc which will move the fingers out of engagement with the teeth so that the plates 32 and 32' may be rotated to the proper position and when the pressure is released upon the pointer 35 the resiliency of the plate will cause the fingers 33 to move forward and engage between two teeth of the disc. It is seen that by this construction an easy operable adjustment of the positions of the fingers is readily made and when the fingers are positioned the plates 32 and 32' are rigidly fixed to the toothed disc 11.

The coil spring 21 not only urges the abutment of the plates 16 and 17 toward the switch operating arm 30 but also allows a further movement of the operating shaft and toothed disc after the switch carrying plate has been tilted if the bi-metallic coil should expand or contract a greater degree than that required to tilt the switch plate, thereby preventing the possibility of the bi-metallic coil from taking a set.

What I claim is:

1. In a mercury switch mechanism, a thermal actuating member, an operating shaft actuated thereby, a tiltable switch carrying plate, means for tilting said plate, and means mounted upon the operating shaft for engaging said tilting means, and means for adjusting the time of said engagement.

2. In a switch operating mechanism, a thermal actuating member, a tiltable switch carrying plate, means upon the plate for tilting the same, an operating shaft actuated by the said thermal member, an operating disc fixed upon said shaft, adjustable abutments rotatably mounted upon said shaft adapted to engage the switch plate tilting means, and means for adjustably positioning and securing said abutments to said operating disc.

3. In a mercury tube switch operating mechanism, a tiltable mercury switch carrying plate, means thereon for tilting said plate, a thermal actuating member, an operating shaft actuated thereby, an operating disc secured thereon, abutment members rotatively mounted upon said shaft adapted to engage the switch plate tilting means, resilient means normally drawing said abutment members toward the tilting means, adjusting members rotatively mounted upon said shaft provided with means for engaging the abutment members and having means adapted to removably engage the operating disc, whereby said adjusting means may be manually positioned at predetermined points upon the operating disc and thereby position the abutment members to tilt the switch plate through the thermal actuating member at predetermined temperatures.

4. In a mercury tube switch operating mechanism, a tiltable mercury switch carrying plate, means thereon for tilting said plate, a thermal actuating member, an operating shaft actuated thereby, an operating disc secured thereon, abutment members rotatively mounted upon said shaft adapted to engage the switch plate tilting means, resilient means normally drawing said abutment members toward the tilting means, adjusting members rotatively mounted upon said shaft provided with means for engaging the abutment members and having means adapted to removably engage the operating disc, whereby said adjusting means may be manually positioned at predetermined points upon the operating disc and thereby position the abutment members to tilt the switch plate through the thermal actuating member at predetermined temperatures, said resilient means acting upon said abutment members providing means after the said abutment has tilted the switch plate to allow further movement of the operating shaft in the same direction.

5. In a mercury tube switch operating mechanism, a tiltable mercury switch carrying plate, means thereon for tilting said plate, a movable actuating member, an operating shaft actuated thereby, an operating disc secured thereon, abutment members rotatively mounted upon said shaft adapted to engage the switch plate tilting means, resilient means normally drawing said abutment members toward the tilting means, adjusting members rotatively mounted upon said shaft provided with means for engaging the abutment members and having means adapted to removably engage the operating disc, whereby said adjusting means may be manually positioned at predetermined points upon the operating disc and thereby position the abutment members to tilt the switch plate through the actuating member upon predetermined movements thereof, said resilient means acting upon said abutment members providing means after the said abutment has tilted the switch plate to allow further movement of the operating shaft in the same direction.

6. In a mercury tube switch operating mechanism, a tiltable mercury switch carrying plate, means thereon for tilting said plate, a thermal actuating member, an operating shaft actuated thereby, an operating disc secured thereon, a temperature scaled disc also fixed upon the said shaft, abutment members rotatively mounted upon said shaft adapted to be engaged to the switch plate tilting means, resilient means normally drawing said abutment members toward the tilting means, adjusting members rotatively mounted upon said shaft provided with means for engaging the abutment members and having means adapted to removably engage the operating disc and provided with pointers adapted to coact with the temperature scaled disc to indicate the temperature

to which the thermal actuating member is subjected, whereby said adjusting means may be manually positioned at predetermined temperatures indicated upon said temperature scaled disc and thereby position the abutment members to tilt the switch plate through the thermal actuating member at predetermined temperatures.

IRA E. McCABE.

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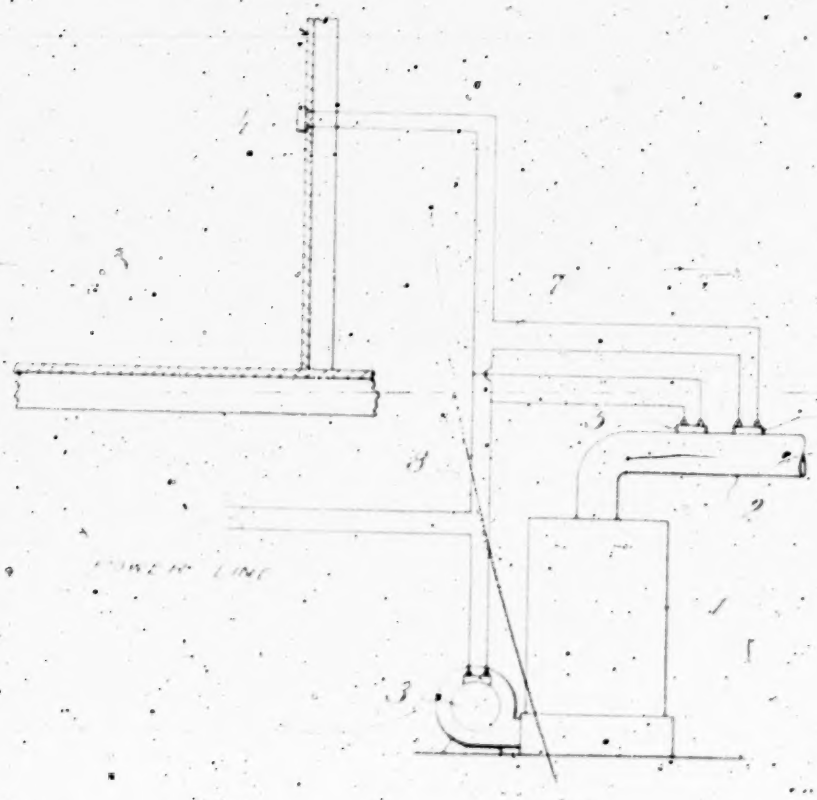
Oct. 11, 1932. R. W. STEM 1,882,341

HEATING FURNACE CONTROL

Filed Sept. 6, 1930



INVENTOR

BY

ATTORNEYS

Patented Oct. 11, 1932

1,882,341

815

# UNITED STATES PATENT OFFICE

RUSSELL W. STEM, OF BETHLEHEM, PENNSYLVANIA, ASSIGNOR TO PENN ELECTRIC SWITCH CO., OF DES MOINES, IOWA

## HEATING FURNACE CONTROL

Application filed September 6, 1930. Serial No. 480,045.

This invention relates to improvements in the thermostatic control of furnaces used for heating houses, offices, shops, other buildings and the like in which motor driven means are used for effecting combustion of fuel, as in burning coal or coke with motor driven forced or induced draft fans and as in burning oil with motor-driven burners. The invention is of special value and application in connection with the use of solid fuels such as coal and coke but it also has certain advantages in the burning of liquid fuels such as oil.

In conventional practice a thermostat actuated by the temperature in the enclosed space to be heated is arranged to start the operation of such motor driven means when the temperature in this space falls below a predetermined minimum limit and to stop such motor driven means when the temperature in this space rises above a predetermined maximum limit. While the results so obtained are fairly satisfactory with respect to control of the temperature in the enclosed space to be heated, within the limits of the thermostats used, this practice disregards several elements essential to efficient operation of the heating furnace. With the usual heating furnace thermal efficiencies fall off rapidly if the temperature of the waste gases escaping through the stack flue exceeds a maximum limit characteristic of the particular heating furnace, and the same is true when the temperature in the fire-box falls below a minimum limit also characteristic but to a lesser extent of the particular furnace. From the standpoint of efficiency, the temperature of the waste gases escaping through the stack flue is much more significant than are the limits within which temperature may be maintained in the enclosed space to be heated.

The present invention provides for the superposing, in a particularly advantageous manner, of control effected by thermostatic means responsive to the temperature in the stack flue upon control effected by thermostatic means arranged in the usual manner. Several important advantages are thus secured.

The invention will be further described in connection with the accompanying drawing which illustrates, diagrammatically and conventionally, an embodiment of the invention. It is intended and will be understood that the accompanying drawing is intended merely to illustrate the invention and that it is not to be interpreted in any limiting sense.

The accompanying drawing illustrates a heating furnace 1 comprising the usual fire-box in which fuel is burned, heat transferring surfaces over which the hot products of combustion from the hot fire-box pass for the transfer of heat to the heating medium, air, water or steam for example, used in the heating system, and a stack flue 2 through which the hot gases from the fire-box which have passed over the heat transferring surfaces escape. The motor of a motor driven means for effecting combustion of fuel in the fire-box is shown at 3. The means shown comprise a fan arranged to provide forced draft through a grate on which coal or coke, for example, is burned. Instead of such a forced draft fan, an induced draft fan may be positioned in the stack flue. Or an oil burner, for example, may be arranged, generally with respect to the heating furnace, as shown in the drawing. A thermostat 4 is arranged in the space to be heated, a room of the building for example, this thermostat being adapted to close the power circuit to the motor 3 when the temperature in this space falls below a predetermined minimum limit and to open this power circuit when the temperature in this space rises above a predetermined maximum limit. A thermostat 5 is arranged in juxtaposition to the stack flue 2, this thermostat being adapted to close the power circuit to the motor when the temperature in the stack flue falls below the predetermined minimum limit independently of the operation of the thermostat 4. That is, the thermostat 5 is adapted to close the power circuit to the motor 3 whenever the temperature in the stack flue 2 falls below a predetermined minimum limit even though the thermostat 4 is operating to maintain the power circuit to the motor 3 opened at the time. A thermostat 6 is advantageously arranged in juxta-

position to the stack flue 2, this thermostat being adapted to open the power circuit to the motor when the temperature in the stack flue rises above a predetermined maximum limit. That is, the thermostat 6 is adapted to open the power circuit to the motor 3 whenever the temperature in the stack flue 2 rises above the predetermined maximum limit even though the thermostat 4 may be operating to maintain this power circuit closed at the time. Certain advantages of the invention may be obtained even though the thermostat 6 be omitted, as noted below, the circuit to the thermostat 4 in such case being completed as indicated at 7. Although the thermostats 4, 5 and 6 are shown in the accompanying drawing as connected directly in the power circuit, more clearly to illustrate the invention, it will be understood that these thermostats may be arranged to open and close the power circuit through a suitable relay as indicated at 8.

The temperatures at which the several thermostats are adjusted to operate may be varied widely to meet the varying requirements of different situations. For example, the thermostat 4 may be adjusted to close the power circuit at a temperature of 68° F. and to open the power circuit at a temperature of 70° F., the thermostat 5 may be adjusted to close the power circuit at a temperature of 600° to 700° F. and the thermostat 6 may be adjusted to open the power circuit at a temperature of 750° to 900° F. It will be obvious that the thermostat 4 may be adjusted to maintain a higher or a lower temperature in the space to be heated. As the heat transferring efficiency of the furnace decreases, the optimum value of the minimum temperature limit at which the thermostat 5 is adjusted to operate usually increases; it may exceed 600° F. in some cases. A maximum temperature limit at which the thermostat 6 is adjusted to operate may be fixed with reference to safety or it may be fixed at a lower value for the purpose of maintaining more efficient furnace conditions.

As applied in conjunction with heating furnaces using solid fuel or liquid fuel, the invention improves the efficiency of the heating furnace by avoiding losses incident to too low fire-box temperatures and to too high stack flue temperatures, avoids excessive stack flue temperatures and assists in the maintenance of more uniform temperatures in the space to be heated. As applied in conjunction with heating furnaces using solid fuel, the invention also avoids objectionable clinkering, by limitation of maximum temperatures, and reduces the danger of fire-box explosions incident to the formation of combustible gases at fire-box temperatures high enough to cause the formation of such gases but not high enough to cause their continuous ignition as formed.

If the thermostat 6 be omitted, the advantages of the invention involved in limitation of the maximum stack flue temperature are lost but those advantages involved in the maintenance of the minimum stack flue temperature independently of the operation of the thermostat actuated by the temperature in the space to be heated are still to be had. Moreover, if the adjustment of the thermostat 4 be varied with respect to time, as by a clock mechanism in conventional practice, omission of the thermostat 6 may assist in bringing the space to be heated to an increased temperature, following such time adjustment, more quickly; in some cases such accelerated recovery of a higher temperature is more important than the improvement in efficiency to be accomplished by limitation of the maximum stack flue temperature.

It will be understood that independent thermostatic elements may be used in the thermostat 4 to effect the opening and to effect the closing of the power circuit thereby and that a single thermostatic element may be used to effect the closing of the power circuit by the thermostat 5 and to effect the opening of the power circuit by the thermostat 6.

Having described my invention, I claim:

1. In combination, a heating furnace comprising a fire-box in which fuel is burned, heat transferring surfaces over which the hot products of combustion from the fire-box pass and a stack flue through which the hot gases from the fire-box escape after passing over the heat transferring surfaces, and motor driven means for effecting combustion of fuel in said fire-box, and a power circuit adapted to supply operating power to said motor driven means, and a thermostat actuated by the temperature in an enclosed space to be heated adapted to close said power circuit when the temperature in said space falls below a predetermined minimum and to open it when the temperature therein rises above a predetermined maximum, and a thermostat actuated by the temperature in said stack flue adapted to close said power circuit when the temperature in said stack flue fails below a predetermined minimum independently of the operation of said first mentioned thermostat, and a thermostat actuated by the temperature in said stack flue adapted to open said power circuit when the temperature in said stack flue rises above a predetermined maximum.

2. In combination, a heating furnace comprising a fire-box in which fuel is burned, heat transferring surfaces over which the hot products of combustion from the fire-box pass and a stack flue through which the hot gases from the fire-box escape after passing over the heat transferring surfaces, and motor driven means for effecting combustion of fuel

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in said fire-box, and a power-circuit adapted to supply operating power to said motor driven means, and thermostatic means actuated by the temperature in an enclosed space to be heated adapted to close said power circuit when the temperature in said space falls below a predetermined minimum and to open said power circuit when the temperature in said space rises above a predetermined maximum, and thermostatic means actuated by the temperature in said stack flue adapted to close said power circuit when the temperature in said stack flue falls below a predetermined minimum even though said first mentioned thermostatic means are at the time operating to open said power circuit and adapted to open said power circuit when the temperature in said stack flue rises above a predetermined maximum even though said first mentioned thermostatic means are at the time operating to close said power-circuit.

3. A stoker control system comprising a motor, a room thermostat, and a thermal controlled stack-switch, all wired in series in a power circuit to control the operation of said motor cooperatively relative to the room temperature and stack temperature, and means controlled by said stack temperature to shunt said room thermostat and operate said motor at a predetermined low stack temperature and independent of said room temperature.

4. A stoker control apparatus including a stoker operating motor and the usual furnace stack, a low limit switch and a high limit switch controlled by stack temperature, a room thermostat, and electrical connections by means of which the low limit switch at low limit temperature dominates motor energization, and by means of which at other temperatures the thermostat and high limit switch can initiate motor energization.

5. A stoker control apparatus including a stoker operating motor and the usual furnace stack, a low limit switch and a high limit switch controlled by stack temperatures, a room thermostat, and electrical connections by means of which the low limit switch at low limit temperature dominates motor energization, and by means of which at temperatures between high and low limits the thermostat and high limit switch can initiate motor energization.

In testimony whereof I affix my signature.

RUSSELL W. STEM.

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Aug. 7, 1934. D J JONES 1,969,136

CONTROL SYSTEM FOR STOKER MOTORS

Filed July 18, 1930

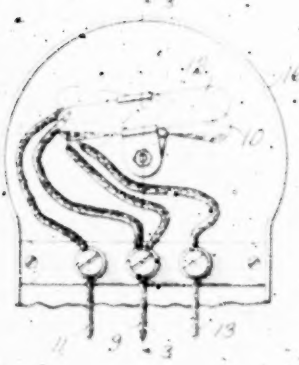

Fig. 2.

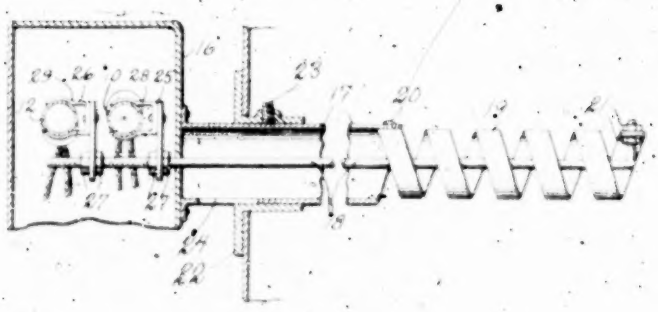

Fig. 3.

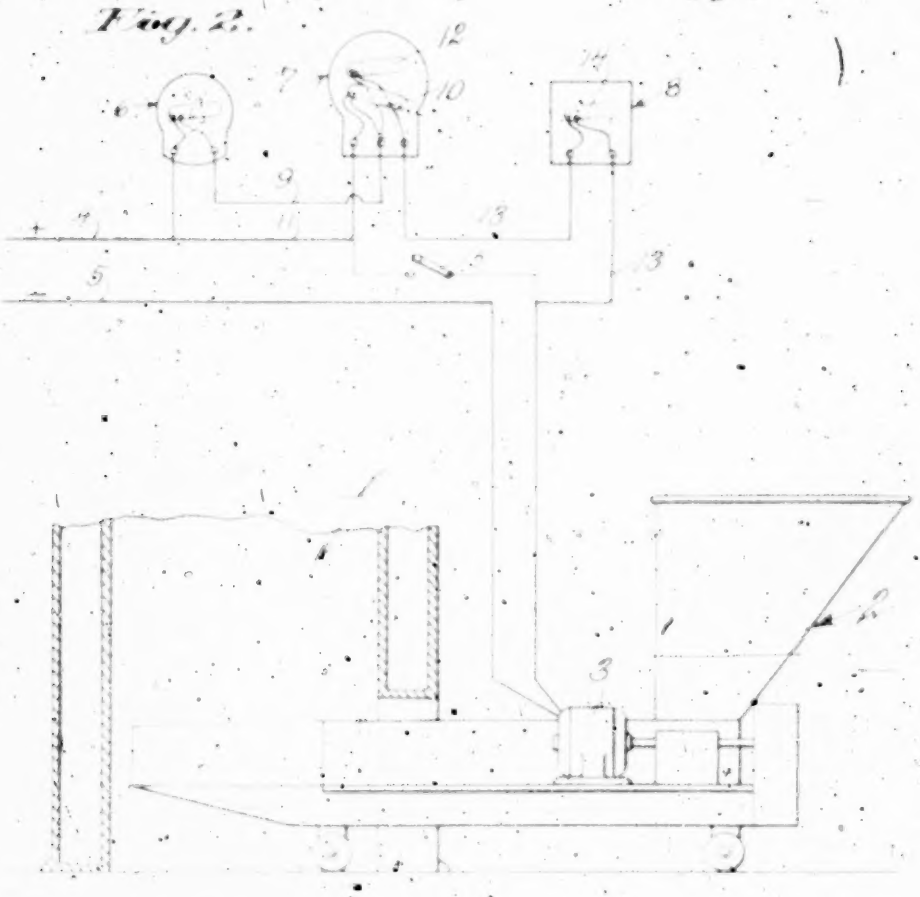

Fig. 1.

Inventor
David J Jones

By
Myers Addington & Owen Sickel
Attorneys.

Patented Aug. 7, 1934 1,969,136

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# UNITED STATES PATENT OFFICE

1,969,136

## CONTROL SYSTEM FOR STOKER MOTORS

David J. Jones, Elmhurst, Ill., assignor, by mesne assignments, to Minneapolis-Honeywell Regulator Company, Minneapolis, Minn., a corporation of Delaware

Application July 18, 1930, Serial No. 468,889

3 Claims. (Cl. 236—9)

My invention relates to control systems for stoker motors, and more particularly to a means for controlling the intermittent operation of the stoker motor relative to the room temperature, the furnace temperature and the temperature of the room-heating medium.

My invention is especially adapted for use in connection with heating plants using hot water, steam or a similar heating medium, in connection with a furnace, in which latter a suitable fuel, such as coal, is automatically fed by means of a suitable stoker.

The present invention contemplates a control system for a stoker motor in which the intermittent operation of the motor for operating the stoker is automatically controlled from a suitable power circuit by means of a control circuit embodying certain switching means including a room thermostat operable by room temperatures, a flue thermostat or stack-switch controlled by the temperature of the furnace stack or flue, and a limit switch controlled by the temperature or the pressure of the heating medium.

The above-mentioned control devices are so arranged in the motor circuit that the room thermostat will operate to close the motor circuit to operate the stoker when the room temperature falls below a certain predetermined degree, if the stack or flue temperature is below a certain predetermined high degree and the limit control switch indicates that the heating medium is in a predetermined condition.

The temperature of the heating medium controls the limit switch to make the operation of the room thermostat and the stack-switch ineffective when the heating medium is hot water and is above a predetermined temperature; that is, when the temperature of the heating medium is above a predetermined degree the limit control switch operates to break the motor circuit and to retain it broken under all conditions until the heating medium temperature again drops below the predetermined degree. In case steam is used, the limit switch may be similarly controlled by a predetermined steam pressure.

It is also an object of the invention to provide a device for the cooperative control of the intermittent operation of the stoker motor through the room temperature, the flue temperature and condition of the heating medium.

A further object is the provision of means whereby the stack-switch may control the operation of the stoker motor through a low temperature differential independent of the room thermostat.

Other objects and advantages of the invention will appear from a consideration of the following detailed description in conjunction with the accompanying drawing, in which:

Figure 1 is a conventional diagrammatic view indicating a heating plant and motor-operated stoker, together with the wiring diagram and elements connected therein for controlling the operation of the motor;

Fig. 2 is a front view of a suitable thermostatically-controlled stack-switch including a plurality of switches controlled by the temperature of the furnace stack or flue; and

Fig. 3 is a longitudinal detail sectional view through the stack-switch taken on a line corresponding to line 3—3 of Fig. 2.

Referring to the drawing in detail, the embodiment illustrated comprises a furnace 1 having a stoker 2 in cooperation therewith, the stoker being operable by means of a motor 3. The stoker may be of any suitable construction for feeding fuel to the furnace as needed. The motor is connected to an ordinary power circuit comprising conductors 4 and 5. The conductor 5 is connected directly to the motor, and in the present instance the temperature controlled elements are connected in the circuit from the conductor 4 and include a room thermostat 6, a thermostatically-controlled stack-switch 7 and a limit-control switch 8. The room thermostat is installed in the space to be heated and may be of any conventional type, designed to make or break the circuit therethrough at a predetermined temperature.

In order to control the stoker motor to maintain a fairly uniform room temperature, the stack-switch 7 is installed in the stack or flue of the furnace and is provided with thermostatic means for operating a plurality of switches. In the present instance two are employed, one of which is designed to be operated to close the circuit for cooperation through the room thermostat to control the operation of the motor when the furnace temperature drops below a certain predetermined high degree, the other switch being automatically operable to control the operation of the motor independently of the room thermostat when the furnace temperature drops below a predetermined low degree. The effective control of the motor through the operation of the stack switch and the room thermostat, of course, is dependent upon the position of the limit-control switch, which is operable to close the circuit, relative to the temperature of the heating medium.

In the wiring diagram in Fig. 1, I have illustrated all of the switches of a mercury contactor type comprising closed glass tubes or capsules having a small amount of mercury therein, into which the ends of the conductors extend at one end of the contactor. When the contactors are tilted in one direction, the mercury will flow to the lower end and the circuit contacts will be closed, and when the contactor is tilted in the opposite direction the mercury will flow to the opposite end and the circuit will be broken, the movement of the contactors being controlled by suitable thermostatic elements.

The room thermostat 6 is illustrated with the switch in closed position, which indicates that the room temperature is below a predetermined degree. This room thermostat is connected to the power conductor 4 and to each of the contactors in the stack-switch by means of a conductor 9 connected to the stack-switch 7. A contactor 10 is connected to the power circuit 4 through a conductor 11, the opposite side being connected to the room thermostat through the conductor 9. The contactor 10 is the low temperature switch; that is, when the temperature in the stack drops to a predetermined low degree the contactor will be tilted to close the circuit.

A contactor 12, operable from the same thermostat means operating the contactor 10, is connected in series with the room thermostat and the limit-control switch 8 through the conductor 9 and a conductor 13, and operates to break the circuit through these conductors and maintain it broken when the stack temperature reaches and maintains a predetermined high degree. The limit-control switch 8 is provided with a similar contactor member 14, which is arranged to break the motor circuit through the conductor 13 when the heating medium reaches a predetermined degree or pressure and to maintain the circuit broken until the temperature or pressure drops below the predetermined point.

If desired, the stoker motor 3 may be operated independently of any of the temperature controlled devices by means of a switch 15 which may be used to shunt the control devices and to connect the motor directly to the power circuit as illustrated.

One embodiment of the stack-switch is illustrated in Figs. 2 and 3, and comprises a thermoelectric device having a casing 16 with a rearwardly extending sleeve 17 secured thereto having a longitudinal rotatably-mounted shaft 18 extending therethrough. A thermostatic element 19 is secured to the sleeve 17 at 20 and is preferably in the form of an outwardly extending helical bimetallic coil, the outer end of which is secured to the upwardly extending end of the shaft 18 by means of securing nuts 21. The stack-switch is mounted on the furnace in such a manner that the thermostatic element 19 will be controlled relative to the temperature in the stack.

A bracket 22 is secured to the furnace wall and the sleeve 17, which is slidably mounted therein, may be secured in adjusted position by means of a set screw 23. When the temperature in the furnace rises, the expansion of the thermostatic element will cause the shaft 18 to rotate in a clockwise direction and as the temperature falls it will rotate in a counter-clockwise direction.

The sleeve 17 is apertured at 24 to permit a certain amount of cold air to be drawn through the sleeve for the purpose of ventilating the thermostatic member 19. The amount of air drawn in by reason of the draft inside the stack may be regulated by adjusting the sleeve member until the desired control of the thermostatic member is obtained. This regulation is desirable so that the thermostatic member will respond to the desired combustion conditions within the combustion chamber of the heating system.

Upwardly extending contactor supporting arms 25 and 26 are secured on the shaft 18, the outer end of the shaft being threaded and the contactor arms adjustably secured in position by means of lock nuts 27. The mercury electric contactors 10 and 12 are mounted on the arms 25 and 26 respectively, by means of suitable clips 28 and 29 secured to the arms. These contactors, as previously described, are preferably in the form of closed glass tubes or capsules forming containers for a small amount of mercury therein for making or breaking the circuit between suitable electrodes in accordance with the angle of inclination of the movable containers, the angular movement being controlled by the expansion and the contraction of the thermostatic element 19 and the consequent rotation of the shaft 18.

With the contactors in the position illustrated in Figs. 2 and 3, if the temperature rises the contactors will be moved in a clockwise direction and the circuit through the contactor 10 will remain broken and the circuit through the contactor 12 will be broken as soon as the temperature rises sufficiently to tilt the contactor 12 in the opposite direction from that shown. In case the temperature falls, the contactors will be rotated in an anti-clockwise direction and the circuit through the contactor 12 will remain closed and the circuit through the contactor 10 will also be closed as soon as the temperature reaches a predetermined low degree. The time at which these circuits are broken or closed may be controlled by adjusting the radial position of the contactor-supporting arms 25 and 26 on the rotatable shaft 18.

Referring now to Fig. 1, when the room thermostat 6 calls for heat the circuit therethrough will be closed and the motor will be operated through the power lines 4 and 5 and the conductors 9 and 13, if the stack-switch contactor 12 is in a position to complete the circuit therethrough, the latter position indicating that the combustion in the furnace and consequent furnace temperature is below a predetermined high degree, and if the limit-control switch 8 is closed, indicating that the heating medium is in a predetermined desired position.

However, in case the stack-switch contactor 12 is in a position to retain the circuit broken, due to high combustion heat in the furnace, the room thermostat will remain ineffective to operate the motor, but if the temperature is below the desired degree, the contactor 12 will be in a position to allow the room thermostat to be effective to operate the motor and fuel to be fed to the combustion chamber.

On comparatively warm days or under certain conditions, the room temperature may remain comparatively high, thus preventing the room thermostat from controlling the operation of the circuit, and the fire in the combustion chamber might become extinguished. In such cases, the reduced temperature in the heating plant causes the mercury contactor 10 to close the circuit therethrough at a predetermined low temperature and the motor 3 will then be operated independently of the room thermostat 6 through the power circuit 4 and 5, and the conductor 11 through the mercury contactor 12 and the conductor 13.

It will be understood that none of the above operations will be effective to control the motor unless the heating medium limit switch and contactor 14 therein is in a position to maintain the circuit closed through conductor 13, indicating that the heating medium is in the desired condition.

From the foregoing description, it will be obvious to those skilled in the art that various modifications and alterations may be made without departing from the spirit and scope of the invention.

I claim:

1. In combination, a heating furnace comprising a fire-box in which fuel is burned, heat transferring surfaces over which the hot products of combustion from the fire-box pass and a stack flue through which the hot gases from the fire-box escape after passing over the heat transferring surfaces, and motor driven means for effecting combustion of fuel in said fire-box, and a power circuit adapted to supply operating power to said motor driven means, and a thermostat actuated by the temperature in an enclosed space to be heated adapted to close said power circuit when the temperature in said space falls below a predetermined minimum and to open it when the temperature therein rises above a predetermined maximum, and a thermostat actuated by the temperature in said stack flue adapted to close said power circuit when the temperature in said stack flue falls below a predetermined minimum independently of the operation of said first mentioned thermostat.

2. The combination with a heating furnace for burning solid fuel and a stack flue for said furnace of means for controlling the rate of combustion of the fuel in said furnace, a first thermostat in control of said combustion-controlling means for increasing and decreasing the rate of combustion in accordance with temperature variations at said first thermostat, a second thermostat responsive to the temperature in said stack flue, and connections between said second thermostat and combustion-controlling means for causing the rate of combustion to be increased whenever the temperature in the stack flue falls to a predetermined minimum irrespective of the temperature at said first thermostat.

3. The combination with a heating furnace for burning solid fuel and a stack flue for said furnace, of means for controlling the feeding of fuel to said furnace, a first thermostat in control of said means for controlling the feeding of fuel to said furnace in accordance with temperature variations at said first thermostat, a second thermostat responsive to the temperature in said stack flue, and connections between said second thermostat and fuel feed controlling means for causing fuel to be fed to said furnace whenever the temperature in the stack flue falls to a predetermined minimum irrespective of the temperature at said first thermostat.

DAVID J. JONES.

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Dec. 15, 1936. S. C. SHIPLEY 2,063,898

CONTROL SYSTEM FOR AUTOMATIC STOKERS

Filed April 20, 1932 3 Sheets-Sheet 1

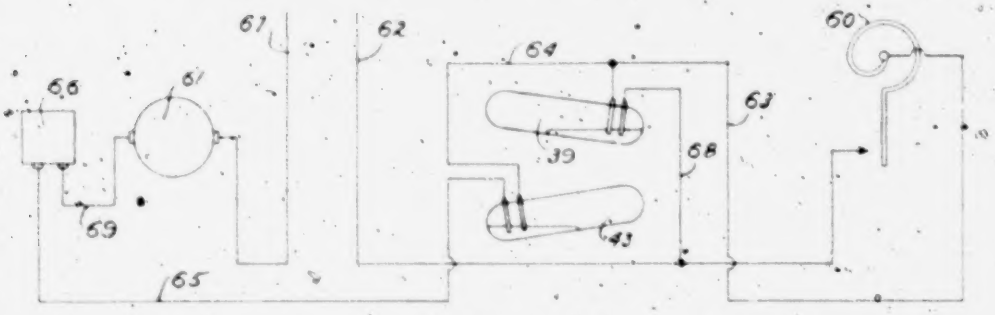


FIG. 1

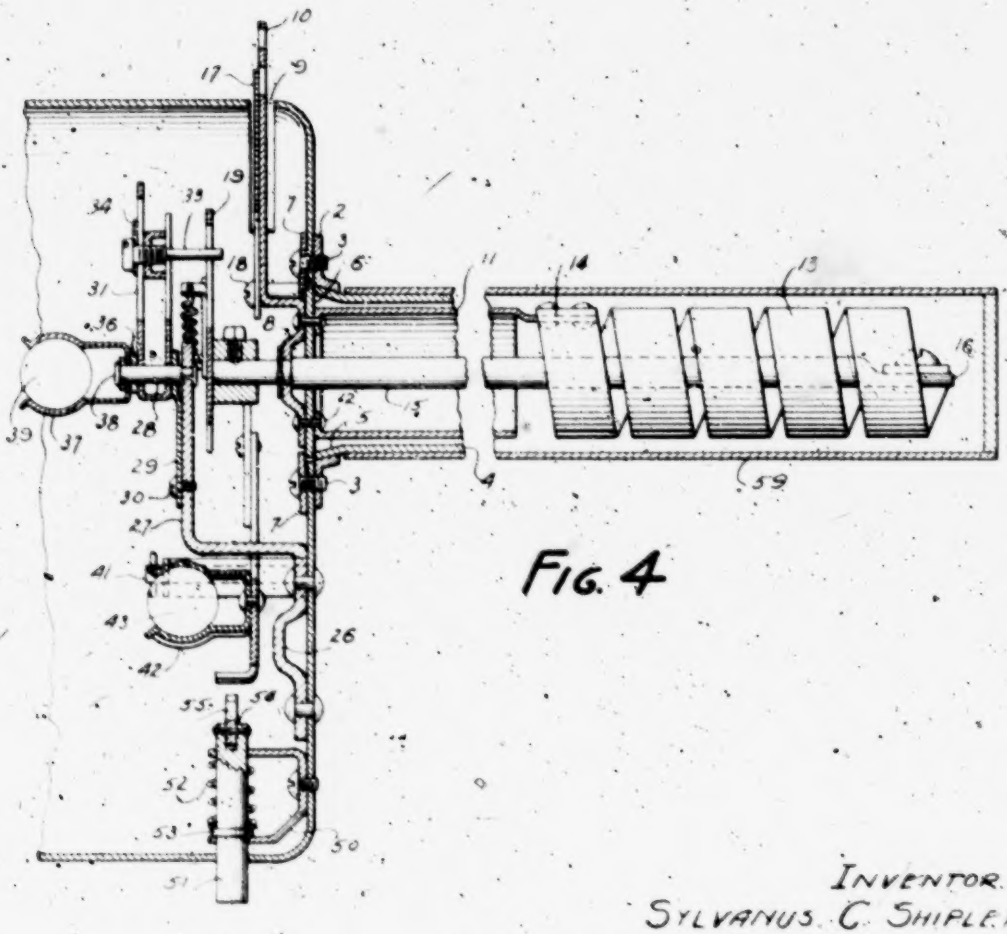


FIG. 4

INVENTOR.
SYLVANUS C. SHIPLEY
By Paul, Paul & Woodcock
ATTORNEYS

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CONTROL SYSTEM FOR AUTOMATIC STOKERS

Filed April 20, 1932 3 Sheets-Sheet 2

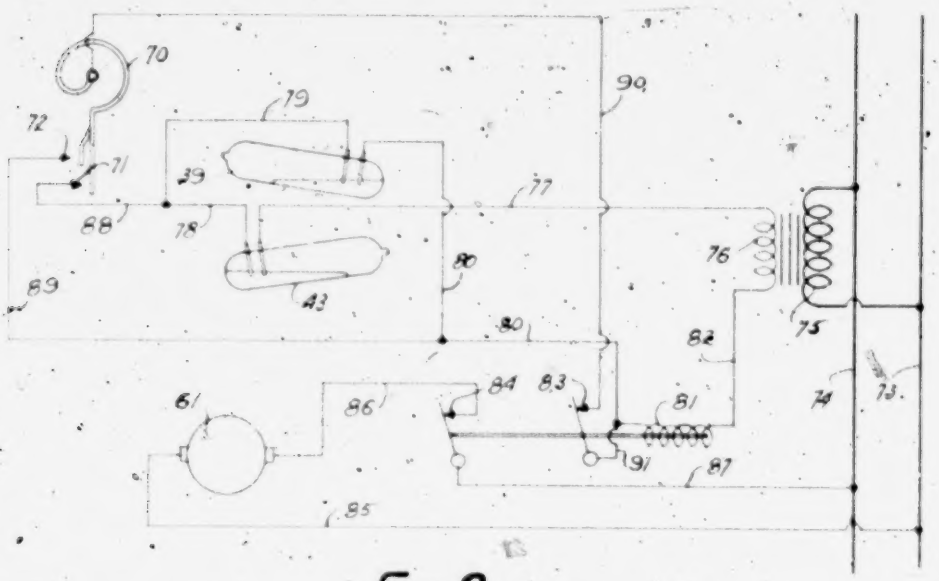


FIG. 2

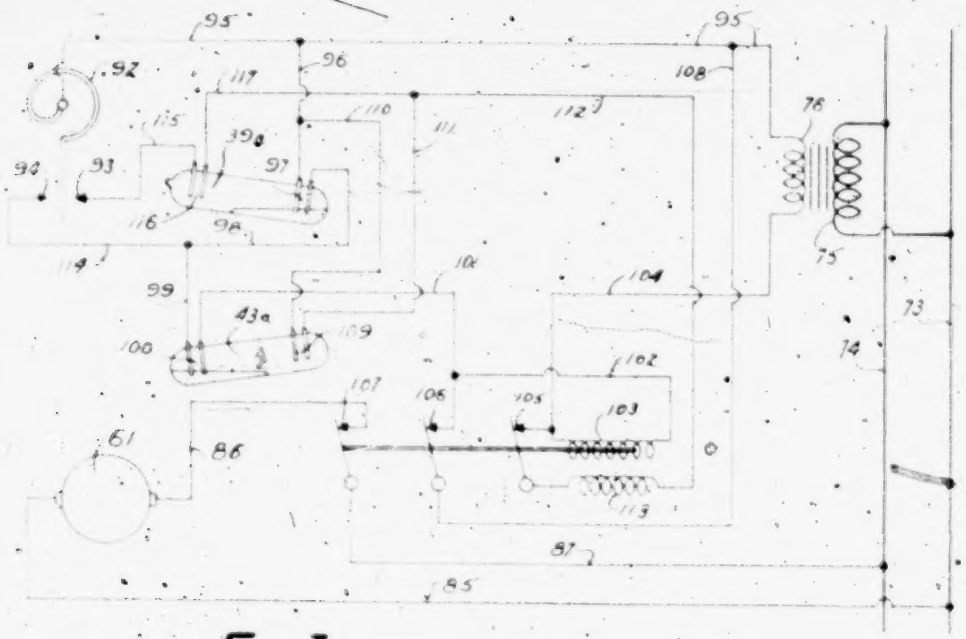


FIG. 3

INVENTOR
SYLVANUS C. SHIPLEY
By Vaul, Vaul & Kilborn
ATTORNEYS

830

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CONTROL SYSTEM FOR AUTOMATIC STOKERS

Filed April 20, 1932 3 Sheets-Sheet 3

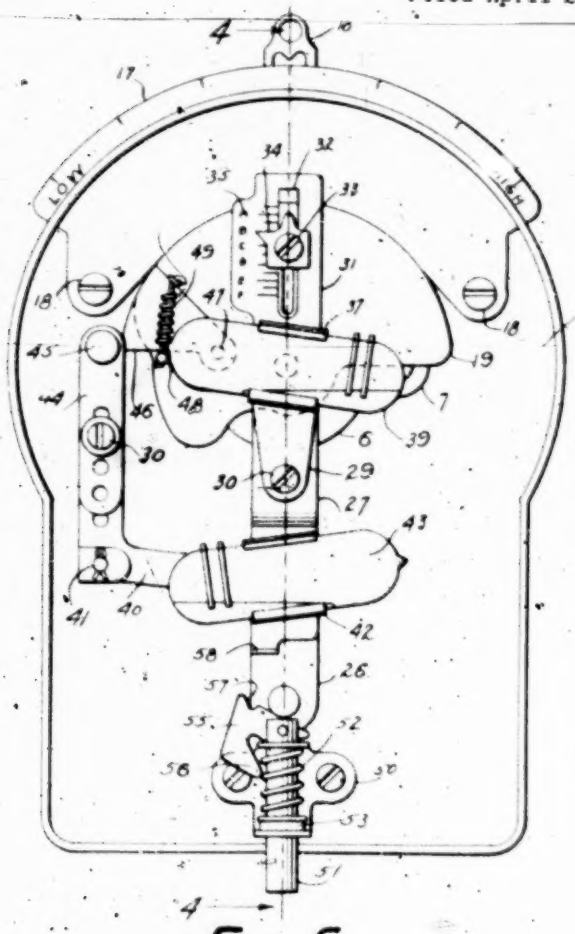


FIG. 5

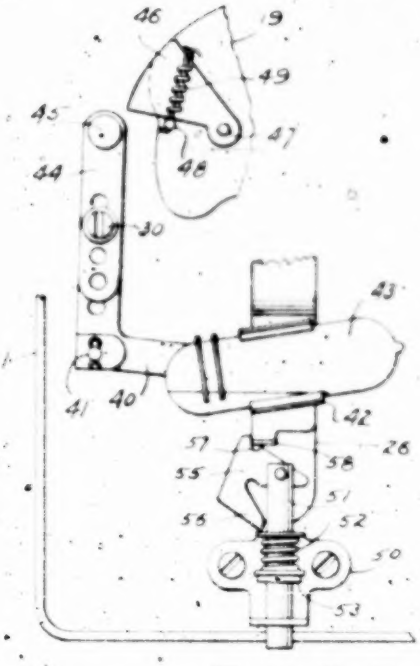


FIG. 5A

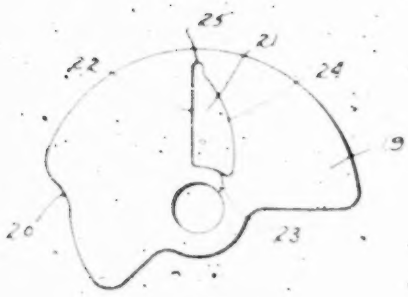


FIG. 6

INVENTOR
SYLVANUS C SHIPLEY
By Paul, Paul & Woodcock
ATTORNEYS

Patented Dec. 15, 1936

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# UNITED STATES PATENT OFFICE

2,063,898

## CONTROL SYSTEM FOR AUTOMATIC STOKERS

Sylvanus C. Shipley, Minneapolis, Minn., assignor to Minneapolis-Honeywell Regulator Company, Minneapolis, Minn., a corporation of Delaware

Application April 20, 1932, Serial No. 606,440

5 Claims. (Cl. 236—9).

In the automatic control of coal stokers for domestic house heating purposes, it has been found in the past that during mild weather conditions the room thermostat only called for heat at prolonged intervals and that in the meantime, between calls for heat, the fire would often go out. As a result raw coal would be fed to the furnace but would not be ignited because the fire was out, which would result in filling the furnace with unburned coal. It was then necessary to clean out all this unburned coal and restart the fire. If mild weather continued, this same condition would occur over and over again causing a great deal of unnecessary labor and allowing the house to fall below the temperature at which it was desired to maintain the same.

In order to overcome this difficulty it has been proposed to provide a device which would operate the stoker even though the house was not calling for heat, in order that the fire would be maintained at all times and ready to receive more coal whenever the house became cold. One method of accomplishing this result was the provision of a program switch, or timer, which operated the stoker for five minutes every hour, which period of firing was deemed sufficient to maintain fire in the furnace even though the room thermostat did not start the stoker because of coldness in the house. Another method of maintaining the stoker fire was the provision of a thermostatic device which responded to the temperature of the fire itself, the temperature of the products of combustion passing through the stack or the temperature of the boiler water which was heated by the fire. In this manner, whenever any one of these temperatures (depending upon the type of control used) fell below a pre-determined minimum, the stoker would be started up by the thermostatic device to build up the fire sufficiently to prevent its going out.

In spite of these precautions, it has been found that sometimes the fires still go out allowing the furnace to be filled with unburned coal, in the same manner as in the old systems wherein no fire maintaining means were provided. If anything, the condition is even worse with one of the improved systems of control when the fire goes out, since the stoker is operated either once every hour or as a result of minimum heat conditions at the furnace, in addition to its being operated by the room thermostat when the house became cold. In the case of these improved systems, therefore, when the fire becomes extinguished, the furnace will be filled with unburned coal even more quickly than would be the case in the old systems, in spite of the precautionary measures taken.

One of the objects of the present invention, therefore is the provision in combination with an automatic control system for stokers, of a device which will prevent the operation of the stoker at any time when the fire has become extinguished.

More specifically, this invention resides in the provision of a thermostatic device subject to a furnace condition such as the temperature of the boiler water, the temperature of the fire itself or the temperature of the products of combustion, which device will open the stoker circuit whenever the temperature falls below a predetermined point, indicating that in all probability the fire has become extinguished.

This invention is intended to cover the use of such devices in any type of stoker control system whether or not it is provided with a means for preventing extinguishment of the fire and regardless of the type of such means if one is used.

A further object of the invention is the provision of a device which will prevent operation of the stoker if it appears that the stoker fire has become extinguished, but which will, if the stoker fire should for any reason increase in intensity, automatically restore the system to normal control.

Still another object of my invention is the provision of a device which will prevent operation of the stoker if it appears that the stoker fire has been extinguished, but in which the device may be set manually when the fire is rekindled, so that the system will resume automatic operation when the fire once more reaches its normal proportions.

A further object of the invention is the provision of an improved thermostatic switch for carrying out the above improvements in stoker control systems.

While in the following description, certain specific embodiments of the invention will be described, it is to be understood that there are many other ways of carrying out the object of this invention and it is not intended to be limited by the specific details hereinafter disclosed.

For a further understanding of the invention, reference may be had to the following description and accompanying drawings, in which:

Figure 1 is a wiring diagram showing the invention in conjunction with a single contact room thermostat and thermostatic means for preventing the extinguishment of the fire;

Figure 2 discloses a system of stoker control

embodying the present invention in conjunction with a holding circuit type of room thermostat operating on low voltage and with the stoker operating on high voltage;

Figure 3 is a wiring diagram showing the present invention applied to a double contact type of room thermostat;

Figure 4 is a longitudinal section of my improved stoker switch taken about on line 4—4 of Figure 5;

Figure 5 is a front view of my improved stoker switch;

Figure 5A is a fragmentary front view showing the lock-out switch held closed by the manually operable means for this purpose; and

Figure 6 shows one of the details of my improved stoker switch.

Referring first to Figures 4, 5, and 6, it will be noted that the stoker switch is housed in a case 1, which is provided with an opening surrounded by flange 2, secured in place by screws 3. A tubular extension 4 is provided with an expanded end 5 and this tubular extension is passed through the opening in case 1 so that its expanded end 5 engages flange 2. A disc 6 substantially fills the opening in case 1 and abuts the periphery of the expanded end 5 of tubular extension 4 and this disc is held in place by means of washers 7 which are secured by screws 3. An operating handle 8 is secured to disc 6 by any suitable means, such as rivets, and extends through a slot 9 in case 1 and terminates in an indicator 10. A tubular member 11 which is concentric with and inside of extension 4 is secured at one end to disc 6, by means of inturned lugs, as shown at 12, and its other end is secured to one end of a helically coiled bimetallic element 13, as indicated at 14. A shaft 15 has one of its ends secured to the free end of bimetallic element 13, as shown at 16, and extends through the coil formed by this element, through disc 6, operating handle 8 and into the interior of case 1. A scale plate 17 is secured to the interior of case 1 by any suitable means, such as the screws shown at 18, and extends through slot 9 in case 1. Scale plate 17 is provided with high, low and intermediate graduations for co-operation with indicator 10 in order that the base temperature to which the device responds may be adjusted.

A cam plate 19, which is secured to collar 20, is mounted on the free end of shaft 15 by means of said collar. The cam plate 19 is substantially semi-circular in shape but has a cam surface provided in its periphery, as shown at 20. Cam plate 19 is also provided with a slot 21 of irregular shape. The slot 21 is provided with a straight radial portion 22, a lower arcuate portion 23, a curved side 24, and an elongated portion 25. The peculiar form of this slot has a very definite purpose which will be brought out hereinafter. A bracket 26 is secured to case 1 below shaft 15 and is provided with an upwardly extended portion 27 provided with an opening which is in alignment with shaft 15. A pin 28 passes through this opening and is secured to extension 27. A leaf spring 29 has one end secured to extension 27, as shown at 30, and its other end is provided with an opening so as to allow the passage of pin 28 therethrough. A U-shaped actuated member 31 is pivoted on pin 28 and the upwardly extending legs thereof are provided with slots 32. A pin 33 extends through the slots 32 and into slot 21 and also clamps an indicator 34 to one of the legs of member 31, which indicator co-operates with graduations 35 carried by said leg. A star shaped friction washer 36 is next placed on pin 28 followed by a mercury switch holder 37 and then a washer 38 after which pin 28 is peened over. Leaf spring 29 exerts pressure against member 31 so that member 31 and switch holder 37 are coupled together by means of friction washer 36 and at all times rotate together about pin 28. The pressure exerted by leaf spring 29 is sufficient to maintain member 31 and mercury switch holder 37 in any position to which they may be moved. A mercury switch 39 is carried by holder 37. This mercury switch will hereinafter be termed the "fire maintaining switch".

The operation of this part of the device is as follows: With the indicator 10 set at any desired point, temperature changes at the bimetallic element 13 result in rotation of shaft 15 which in turn rotates cam plate 19. The edges formed by slot 21 engage pin 33 to move member 31 and in turn tilt the mercury switch 39. It will be noted that the graduations 35 are evenly spaced and in order for each graduation to represent the same number of degrees in temperature change, it has been necessary to provide the peculiar configuration of slot 21. With pin 33 moved up to such a position that indicator 34 is opposite graduation A, the extended end of pin 33 will be in the elongated portion designated 25 of slot 21. Under these conditions, as cam plate 19 is rotated back and forth in response to temperature changes at bimetallic element 13, fire maintaining switch 39, will be tilted back and forth without any lost motion. As indicator 34 is moved downwardly to positions B, C, D, etc., the end of pin 33 will move into progressively wider parts of the slot 21 so that there will be an increased amount of lost motion between cam plate 19 and pin 33 so as to provide an adjustable differential in the operation of fire maintaining switch 39. It has been formerly stated the pressure exerted by leaf spring 29 is sufficient to hold fire maintaining switch 39 and member 31 in any position to which it may be moved by the lost motion connection provided by pin 33 and slot 21. In former instruments, the mercury switch, after having moved past the center, has been allowed to continue rotating by gravity to the extent of the lost motion connection. This feature has been eliminated herein for a specific reason since it has been found that the lead wires to the mercury switch tend to hold the mercury switch in some one of its positions and even tend to move the switch back to such position when the force acting thereon has been removed. The pressure set up by leaf spring 29 is sufficient to overcome this tendency of the leads of the mercury switch and maintains it in any position to which it is moved by cam plate 39. The result is positive and accurate operation of the instrument. Adjustment of indicator 10 rotates tubular member 11 to adjust the fixed end of the bimetallic element 13 so as to change the base temperature setting of the instrument.

A bell-crank 40 is pivoted on a pin 41 carried by case 1 and has a substantially horizontal arm to which is secured a mercury switch holder 42, which in turn carries a mercury switch 43. This mercury switch will hereafter be termed the "lock-out switch." The other arm of the bell-crank is substantially vertically disposed and is provided with an adjustable extension 44 which carries a pin 45 at its end, the pin being adapted to co-operate or ride upon the periphery of cam plate 19. A cam 46 is pivoted to cam plate 19, as shown at 47, and is biased normally into en-

gagement with a pin 48 by means of a coiled spring 49. The cam 46, when it is in engagement with pin 48, serves as an extension of the periphery of cam plate 19, so that in effect the periphery of the cam plate 19 extends in a perfect radius beyond the cut-in cam portion 20. A bracket 50 is secured to the lowermost portion of case 1 and journals a vertical movable rod 51 which is normally biased to move downwardly by means of a spring 52, one end of which abuts the bracket 50 and the other end of which abuts a washer secured to or an enlarged portion 53 formed in rod 51. The upper portion of rod 51 is slotted as at 54 to pivotally receive a catch 55. Catch 55 is provided with a downwardly extending finger 56 and also with a notch 57 located at its upper portion. The substantially horizontal arm of bell-crank 40 is provided with a bent-over extension 58 which overlies catch 55 and under certain conditions engages notch 57.

The part of the thermostatic switch just described above comprises the means for shutting down the stoker when the fire goes out. When the fire in the furnace goes out the temperature of element 13 falls to such a degree that cam plate 19 is rotated in a clockwise direction until pin 45 rides over the periphery of cam 46 and drops against the portion 20 of cam plate 19, which allows bell-crank 40 to rotate clockwise about pin 41 moving lock-out switch 43 to open circuit position. If for any reason the temperature drops far enough to cause the opening of lock-out switch 43 and then due to a change of wind direction or for some other cause the fire picks up, increasing the temperature of element 13, cam plate 19 will be rotated in a counter-clockwise direction. Pin 45 will bear against the lower edge of cam 46 rotating the same in a clockwise direction against the action of the spring 49. On continued rise in temperature pin 45 will ride up cam surface 20 until it reaches the radial periphery of cam plate 19 whereupon cam 46 will be returned to its normal position abutting pin 48. Cut-out switch 43 is moved to closed position by this action.

It should be noted that there is a temperature differential between opening of lock-out switch 43 and closing thereof under these conditions. In order for lock-out switch 43 to open, the temperature at thermostatic element 13 must drop to such a point that pin 45 rides off cam 46 which is then in engagement with pin 48 to extend the periphery of plate 19. For lock-out switch 43 to close automatically, however, the temperature must rise sufficiently for pin 45 to rotate cam 46 about its pivot and ride up on cam surface 20 until it engages the radial periphery of cam plate 19.

The stoker cannot be operated when lock-out switch 43 has moved to open circuit position as will be hereinafter more fully explained. If the fire goes completely out, it may of course be rekindled manually and built up until the temperature to which element 13 responds has become sufficiently high to move lock-out switch 43 to closed circuit position after which automatic operation will be resumed as above explained. Ordinarily, however, it will be desired to only start the fire manually and then let the stoker build up the fire. In order to accomplish this result it is necessary that lock-out switch 43 may be manually moved to closed circuit position and then maintained in that position until the temperature of element 13 becomes sufficiently high to hold lock-out switch in closed circuit position by means of cam plate 19 and cam 46. If this operation is desired, the rod 51 is moved upwardly until finger 56 of catch 55 rests on bracket 50 and the left hand edge of slot 57 engages the left side of extension 58 and moves bell-crank 40 in counter-clockwise direction until lock-out switch 43 is in closed circuit position (see Fig. 5A). This movement of bell-crank 40 positions pin 45 so that it will readily ride upon cam 46 when the temperature of element 13 has been restored. Rod 51 is maintained in its raised position by finger 56 resting on bracket 50 and 56 is held in this position by the engagement of notch 57 with the left side of extension 58. When the temperature of element 13 rises sufficiently cam 49 will move counter-clockwise until it picks up pin 45 and moves it slightly to the left. This causes extension 58 to be moved up out of engagement with notch 57 whereupon spring 52 will move rod 51 down to the position shown in Figure 5.

It will be noted that this combined instrument has several adjustments. First the indicator 16 may be moved to adjust what might be called the base temperature at which the fire maintaining switch 39 will be moved to closed position by engagement of pin 33 with straight portion 22 of slot 21. Adjustment of pin 33 vertically changes the differential between opening and closing movements of switch 39 and, lastly, adjustable extension 44 changes the temperature at which lock-out switch 43 will be operated in relation to the base temperature setting.

In order to protect bimetallic element 13 from the corrosive effects of the products of combustion, a protecting tube 59 may be provided if desired.

Referring now to Figure 1, there is shown a simple circuit diagram showing the manner in which this device is used in a stoker control system to prevent operation of the stoker if the fire becomes extinguished. A single contact room thermostat is indicated at 60 and upon closure of the room thermostat on a call for heat, stoker motor 61 is energized through the following circuit: Line 62, room thermostat 60, conductor 63, conductor 64, lock-out switch 43, conductor 65, limit control 66, stoker motor 61 and line 67. It will be noted that the room thermostat cannot start stoker motor 61 if lock-out switch 43 is in open circuit position. If the room is sufficiently warm but the temperature condition of the furnace drops to such a degree that the fire might go out, fire maintaining switch 39 is moved to closed position establishing the following circuit: line 62, conductor 68, fire maintaining switch 39, conductor 64, lock-out switch 43, conductor 65, limit control 66, conductor 69, stoker motor 61 and line 67. It will again be noted that the fire maintaining means represented by mercury switch 39 is unable to operate the stoker motor 61 if the lock-out switch 43 is in open circuit position.

Figure 2 shows another manner of utilizing my novel control system in which low voltage is used in all of the circuits except that of the stoker motor 61. This circuit also utilizes the holding circuit type of room thermostat indicated at 70 which is provided with contacts 71, 72. Contact 71 makes prior to 72 on a fall in temperature and breaks after 72 on a rise in temperature. Lines 73 and 74 supply current to the primary 75 of a transformer. The room is shown as warm but the fire maintaining switch 39 is closed, setting up the following circuit: second-

ary 76 of the transformer, conductor 77, lock-out switch 43, conductors 78, 79, fire maintaining switch 39, conductor 80, relay coil 81 and conductor 82 to secondary 76. Energization of relay coil 81 has closed switches 83 and 84, the latter of which energizes stoker motor 61 as follows: line 73, conductor 85, stoker motor 61, conductor 86, switch 84 and conductor 87. It will be noted that the circuit for relay coil 81 cannot be completed unless lock-out switch 43 is in closed circuit position. When the fire has been built up sufficiently, switch 39 will open and de-energize relay coil 81 to thereby discontinue operation of stoker motor 61. If the room temperature falls, contact 71 first closes and then contact 72 closes setting up the following circuit for relay coil 81: secondary 76, conductor 77, lock-out switch 43, conductors 78, 88, contacts 71 and 72, conductors 89, 80, relay coil 81 and conductor 82 back to secondary 76. Energization of relay coil 81 again closes relay switches 81 and 84, the latter of which energizes stoker motor 61 as above explained and the former of which closes a holding circuit for relay coil 81 which is dependent only on contact 71 and not on contact 72. This holding circuit is as follows: secondary 76, conductor 77, lock-out switch 43, conductors 78, 88, contact 71, thermostat 70, conductor 90, switch 83, conductor 91, relay coil 81 and conductor 82 back to 76. It will be noted that here again both the starting circuit and the holding circuit for relay coil 81, as energized by the room thermostat 70, are dependent upon lock-out switch 43 being in the closed circuit position.

Figure 3 shows the manner in which my invention may be applied to a double contact type room thermostat. In this instance the fire maintaining switch 39*a* and the lock-out switch 43*a* are of the type which make a circuit in both their hot and cold positions. The parts in Figure 3 are shown with the lock-out switch 43*a* in hot position and the fire maintaining switch 39*a* in cold position and the room thermostat 92 midway between its hot and cold contacts 93 and 94 respectively. The line wires, and primary and secondary of the transformer are again denoted 73, 74, 75, and 76 respectively. With 39*a* in its cold position the following circuit is set up: secondary 76, conductor 95, conductor 96, cold contacts 97 of fire maintaining switch 39*a*, conductors 98, 99, hot contacts 100 of lock-out switch 43*a*, conductors 101, 102, pull coil 103 of the relay unit and conductor 104 back to secondary 76. Energization of 103 closes switches 105, 106, and 107, the latter of which controls the stoker motor 61 as in Figure 2. Contacts 106 establish the following holding circuit for relay coil 103: secondary 76, conductor 95, conductor 108, switch 106, conductor 102, pull coil 103, conductor 104 to 76. It will be seen that opening of contacts 97 or 100 will not de-energize pull coil 103. If the fire should die out, however, cold contacts 109 of lock-out switch 43*a* would be closed, setting up the following circuit: secondary 76, conductors 95, 96, 110, cold contacts 109 of lock-out switch 43*a*, contactors 111, 112, neutralizing coil 113, contacts 105, and conductor 104 to secondary 76. The magnetic effect of neutralizing coil 113 neutralizes the magnetic effect of pull coil 103 allowing switches 105, 106, and 107 to open by gravity. Such relays are old in the art of automatic controls. If the room becomes cold, closing contacts 94, an energizing circuit for pull coil 103 is established as follows: secondary 76, conductors 95, 92, 94, conductors 114, 99, hot contacts 100 of lock-out switch 43*a*, conductors 101, 102, pull coil 103, and 104 back to secondary 76. It will be seen that this energizing circuit again is dependent upon the lock-out switch 43 being in its hot position. Energization of coil 103 again closes switches 105, 106, and 107 as above explained. With the stoker operating and the fire burning, both the room thermostat 92 and the fire maintaining switch 39*a* must reach their hot positions before the stoker will be shut down. This circuit for energizing neutralizing coil 113 to allow switches 105, 106, and 107 to open is as follows: secondary 76, 95, 92, contacts 93, conductor 115, hot contacts 116 of fire maintaining switch 39*a*, conductors 117, 112, neutralizing coil 113, switch 105, and conductor 104 to 76.

From the foregoing it will be seen that by my invention I have provided an improvement in stoker control systems which may be applied to any of the well known thermostatic control circuits. Although no high limit control has been shown in the diagrams of Figures 2 and 3, they could well be inserted since such instruments are standard devices which are on the open market.

Although in all of the description and drawings mercury switches have been used in the device which is subject to furnace conditions, it is to be understood that open contacts could easily be substituted without changing the operation of the various systems. Likewise, mercury switch room thermostats could be substituted for the open contact room thermostat shown and described.

It should be further understood that my novel lock-out control for preventing operation of the stoker when the fire has become extinguished can equally well be applied to those stoker systems in which it is attempted to maintain the fire at all times by timed firing periods instead of by a minimum heat condition as described and explained herein.

This means of preventing operation of the stoker may also be applied to those systems in which the fire maintaining mechanism for maintaining the fire during periods of mild weather is omitted.

In the claims, the term "fire maintaining switch" will be used to include any switching mechanism (open contacts or mercury switches, temperature responsive or time controlled) which is intended to prevent extinguishment of the fire during mild weather or low heat requirement conditions. The term "lock-out switch" will be used to include any switching mechanism for preventing operation of the stoker when the fire is extinguished. The expression "responsive to a furnace condition" will include any condition directly responsive to the temperature of the fire such as temperature of the products of combustion in the combustion pot, stack or intermediate passages, the temperature of the fuel bed or heat given off thereby or the temperature or pressure of the fluid circulating medium at the furnace or boiler and heated thereby. The expression "temperature of the products of combustion" will include the temperature of the fuel bed or gases leaving the same and passing to the chimney of the furnace to boiler. The term "mercury switch" as used in the claims is intended to include only those switches which are self contained and comprise an envelope, two or more electrodes therein and a fluid body of conducting material for bridging said electrodes when the envelope is tilted in one direction.

I claim as my invention:

1. In a system for controlling the temperature of a space having a furnace, the combination of, means for supplying fuel to the furnace, means responsive to space temperatures for controlling said fuel supplying means, means responsive to furnace temperatures for preventing operation of said fuel supplying means when the fire becomes substantially extinguished, and latch means for operating said last mentioned responsive means to permit operation of said fuel supplying means.

2. In a system for controlling the temperature of a space having a furnace, the combination of, means for supplying fuel to the furnace, means responsive to space temperatures for controlling said fuel supplying means, means responsive to furnace temperatures for preventing operation of said fuel supplying means when the fire becomes substantially extinguished, latch means for operating said last mentioned responsive means to permit operation of said fuel supplying means, and means for releasing said latch means and controlling said last mentioned responsive means when the fire is restored.

3. In a system for controlling the temperature of a space having a furnace, the combination of means for supplying fuel to the furnace, means responsive to space temperatures for controlling said fuel supplying means, means responsive to furnace temperature for controlling said fuel supplying means, means responsive to furnace temperatures for preventing operation of said fuel supplying means by either of said responsive means if the fire becomes substantially extinguished, and latch means for operating said last mentioned responsive means to permit operation of said fuel supplying means.

4. In a system for controlling the temperature of a space having a furnace, the combination of means for supplying fuel to the furnace, means responsive to space temperatures for controlling said fuel supplying means, means responsive to furnace temperature for controlling said fuel supplying means, means responsive to furnace temperatures for preventing operation of said fuel supplying means by either of said responsive means if the fire becomes substantially extinguished, latch means for operating said last mentioned responsive means to permit operation of said fuel supplying means, and means for releasing said latch means and controlling said last mentioned responsive means when the fire is restored.

5. In a system having a furnace for controlling the temperature of a space, the combination of means for supplying fuel to the furnace, means responsive to space temperatures for controlling said fuel supplying means, means to operate said fuel supplying means to maintain the fire alive when the system is operating under low heat requirement conditions, means responsive to furnace temperatures for preventing operation of said fuel supplying means either by said space temperature responsive means or said last named means if the fire becomes substantially extinguished, and latch means for operating said last mentioned responsive means to permit operation of said fuel supplying means.

SYLVANUS C. SHIPLEY.

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APPARATUS FOR CONTROLLING STOKERS

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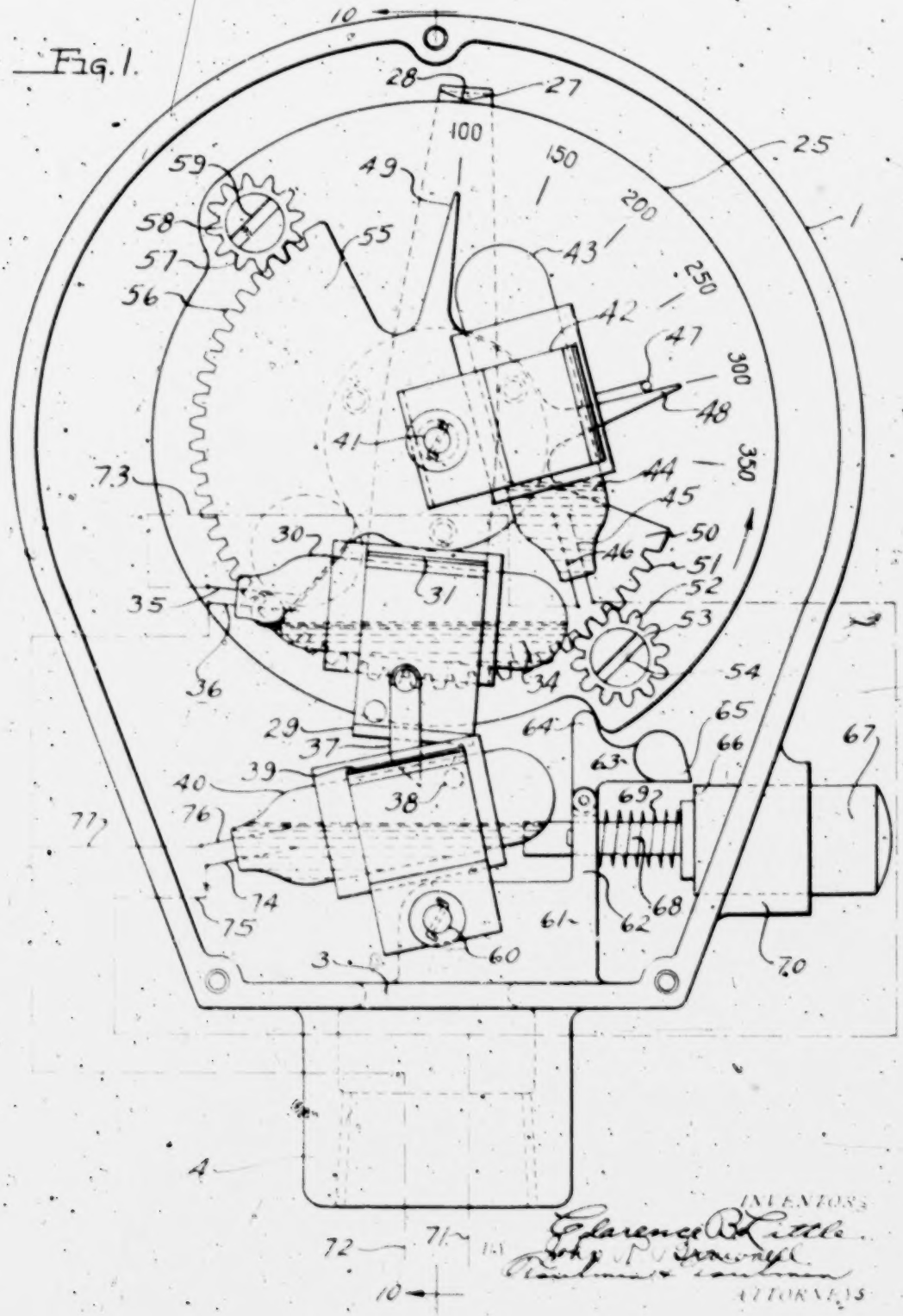
Fig. 1.




INVENTORS
Clarence R. Little
J. R. Brownell
ATTORNEYS

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APPARATUS FOR CONTROLLING STOKERS

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Fig. 2.

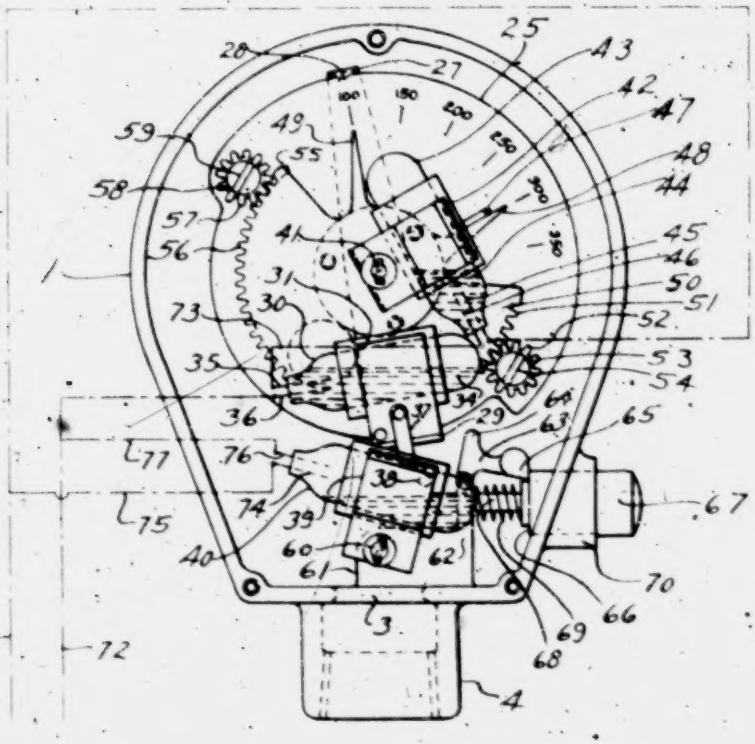
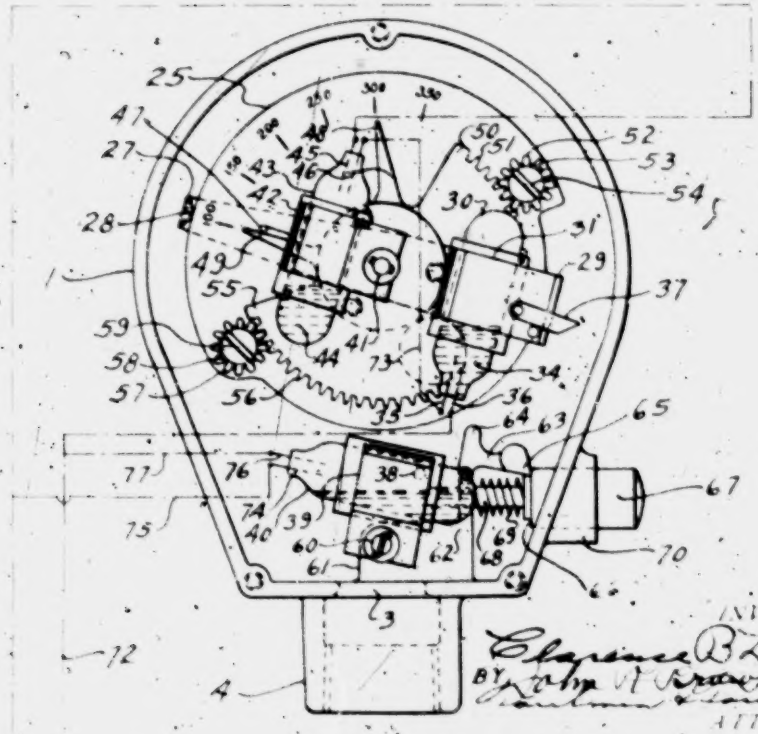



Fig. 3.




INVENTORS
Clarence B. Kittle
BY John W. Brownell
ATTORNEYS

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APPARATUS FOR CONTROLLING STOKERS

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Fig. 4.

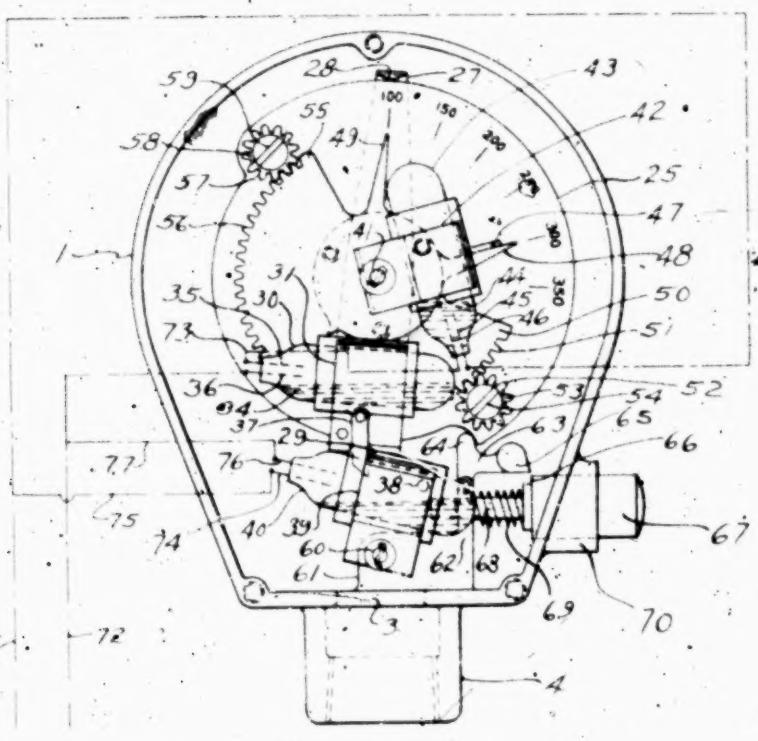



Fig. 5.

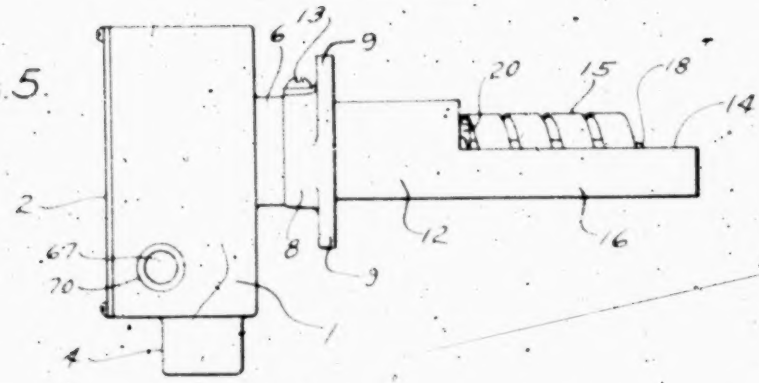
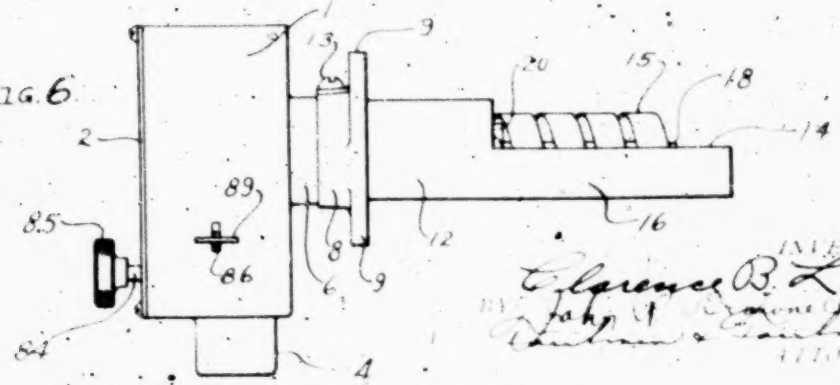



Fig. 6.




INVENTORS
Clarence B. Little
John A. Brownell
ATTORNEYS

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APPARATUS FOR CONTROLLING STOKERS

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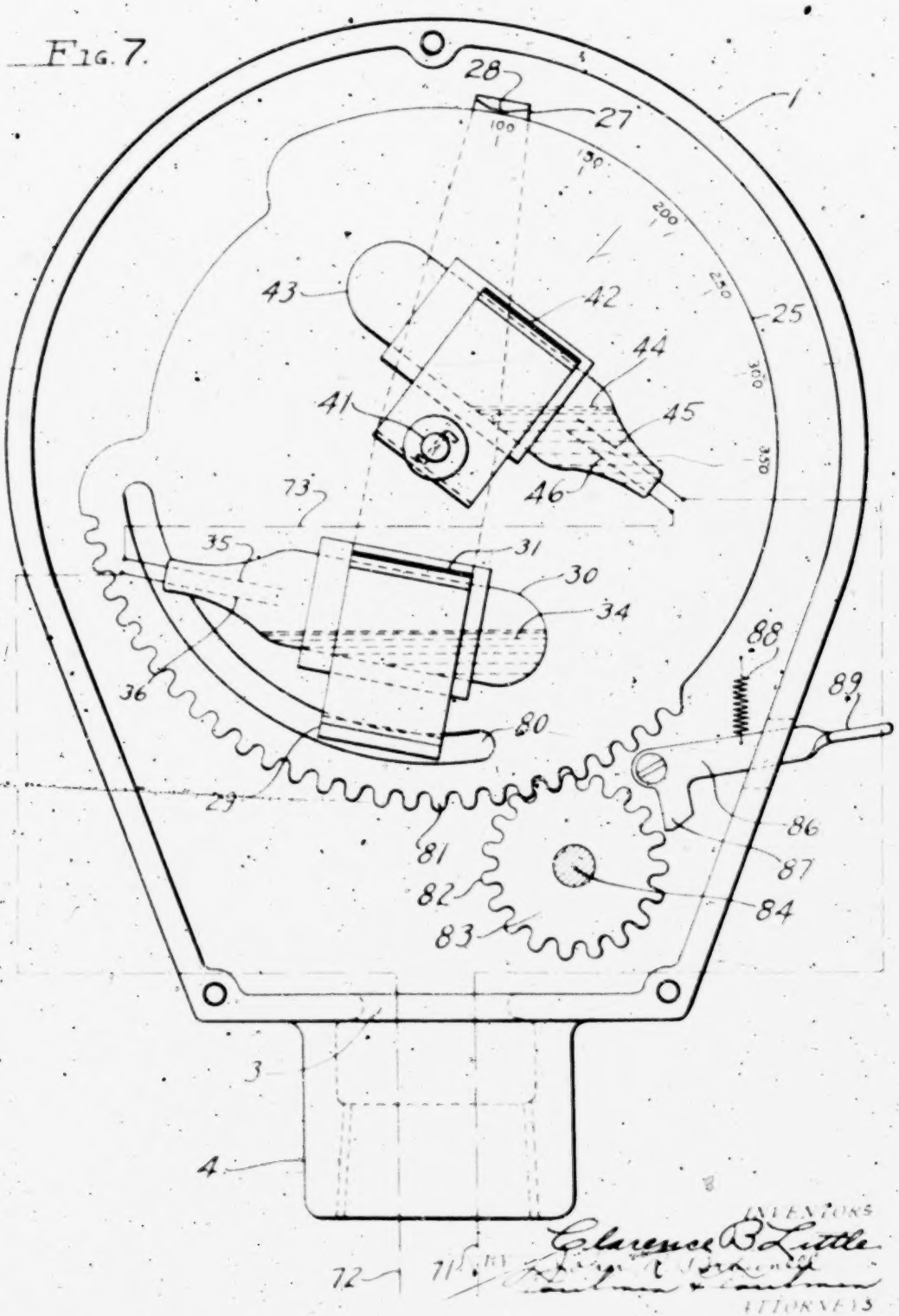
Fig. 7.




INVENTORS
Clarence B. Little
ATTORNEYS

APPARATUS FOR CONTROLLING STOKERS

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Fig. 8.

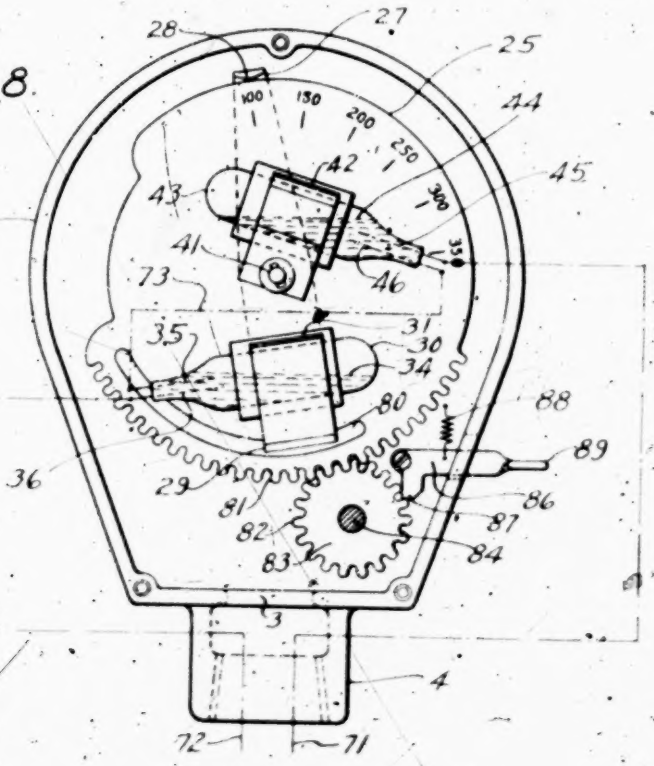
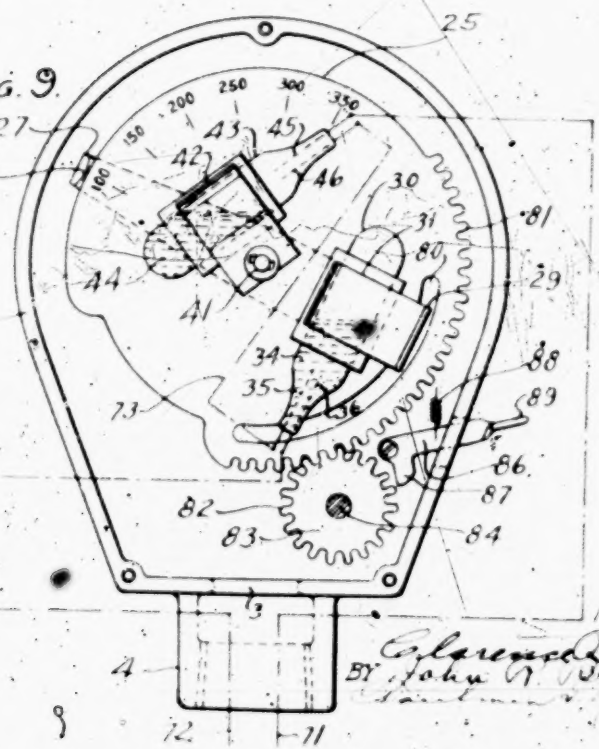



Fig. 9.




INVENTORS
Clarence B. Little
BY John R. Brownell
ATTORNEYS

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APPARATUS FOR CONTROLLING STOKERS

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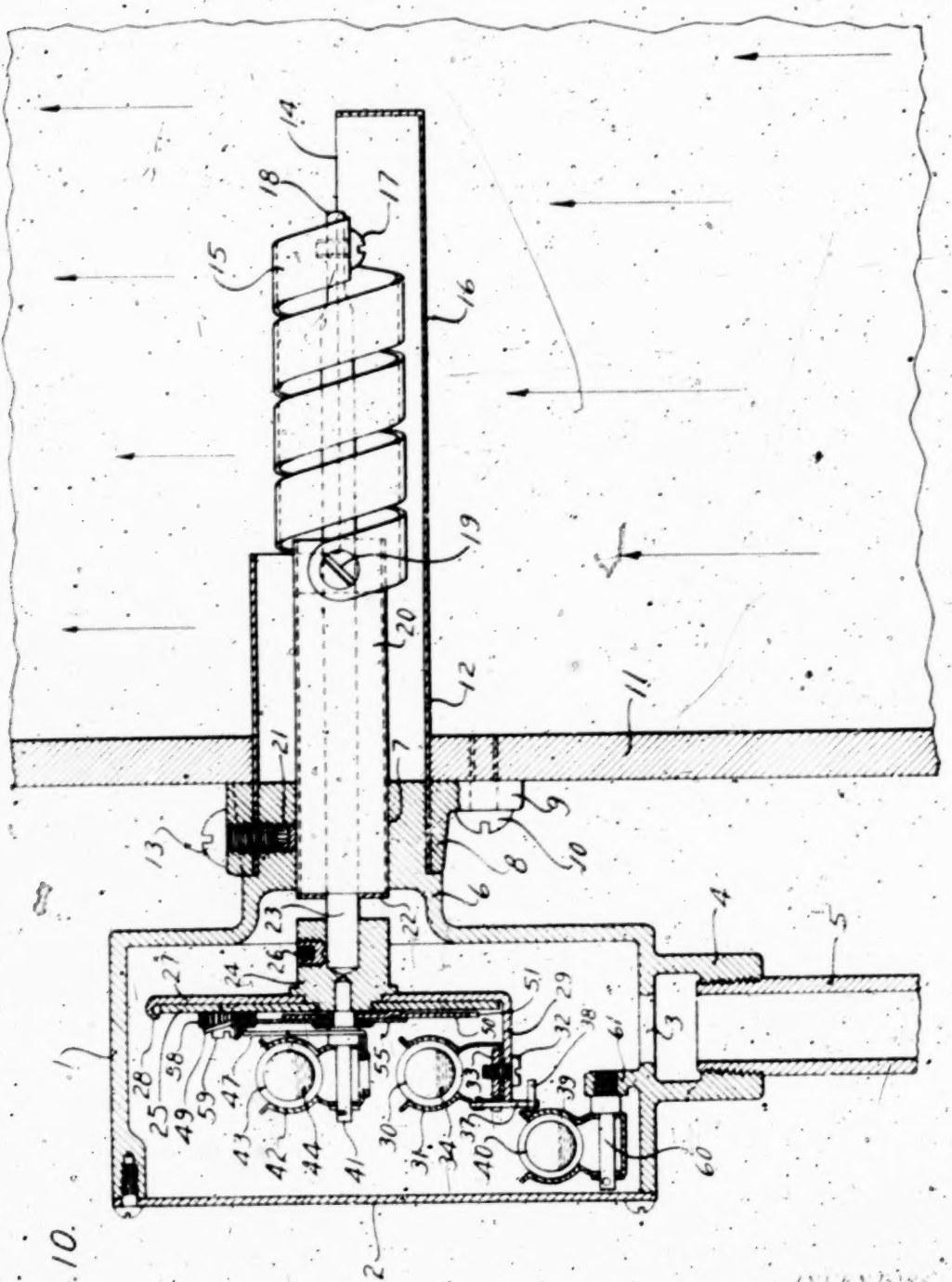

Fig. 10.

INVENTORS
Clarence B. Little
John R. Brownell
ATTORNEYS

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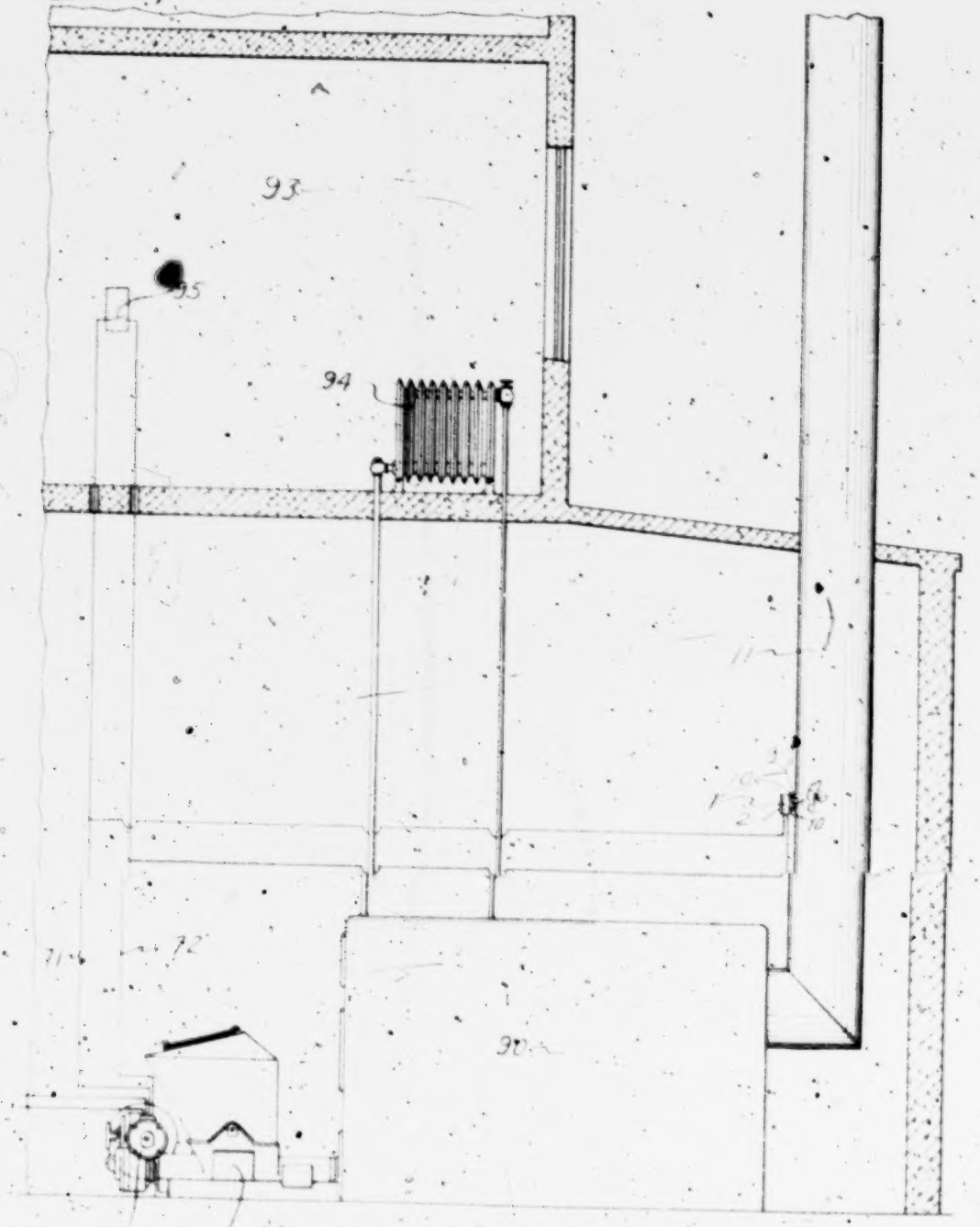
Fig. 11.




INVENTORS
Clarence B. Little
John R. Brownell

ATTORNEYS

Patented Dec. 15, 1936

2,064,193

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# UNITED STATES PATENT OFFICE

2,064,193

## APPARATUS FOR CONTROLLING STOKERS

John R. Brownell and Clarence B. Little, Dayton, Ohio, assignors, by mesne assignments, to Minneapolis-Honeywell Regulator Company, a corporation of Delaware

Application March 13, 1931, Serial No. 522,447

35 Claims. (Cl. 236—9)

Our invention relates to an apparatus for controlling stokers and the like in connection with the regulation of the temperature in an enclosure to which heat is supplied by the stoker in connection with the boiler that the stoker is attached to.

Heretofore, the stoker started and stopped depending upon the closing of the electric circuit connected to the motor of the stoker and this circuit was closed or opened depending upon the temperature of the enclosure which was being heated by the boiler to which the stoker was attached.

In circumstances where the room or enclosure remained warm for a considerable period, it was found that the stoker, not operating to feed green coal, the fire would go out.

This thermostatic control in the electric circuit connected to the motor and to the thermostat in the enclosure has this object:

Thermostatic devices are located in the stack in series, one of which moves within the maximum ranges of temperature within which it is desired that the motor circuit shall be closed irrespective of the temperature conditions in the enclosure being heated, so that, if the enclosure thermostat does not close to start up the stoker before the fire goes out, the cooling of the stack will cause these thermostatic devices to close the circuit and start up the stoker for a sufficient period within a certain temperature range as indicated in the stack to replenish the fire before it goes out.

Referring to the drawings:

Figure 1 is an elevation of the face of the stack thermostat with the front cover removed, showing the parts where the fire in the stoker has completely died out, it has just been rebuilt, the starting button has been pushed and the starting contact has been pushed into contact-making position.

Figure 2 shows a similar view with the parts in running condition and the temperature is beginning to rise in the stack so that the starting contact has been thrown into inoperative position by the running contacts.

Figure 3 is a similar view showing the running contacts in position where the heat has gotten up to 300 degrees in the stack and due to the excessive heat the running contacts are off and the parts are now returning towards the position shown in Figure 2.

Figure 4 is a similar view showing the parts in "off" position with the fire out and the starting contact ready to be put into starting position as in Figure 1 by the pressure of the starting buttons;

Figure 5 is a side elevation of the thermostatic casing and the thermostatic element;

Figure 6 is a similar view of a modified form of this thermostatic control;

Figure 7 is a front elevation with the cover removed of a modified form of control shown in position with the fire out and the parts are being moved up into starting position;

Figure 8 is a similar view showing the parts in starting position after resetting by hand;

Figure 9 is a similar view showing the parts in "off" position with the temperature up and with the contacts just starting to revolve backwardly as the temperature descends;

Figure 10 is a section on the line 10—10 of Figure 1;

Figure 11 is a diagrammatic view of the boiler, stoker, stoker motor, stack, enclosure and connection between the motor, room thermostat and stack thermostatic control.

Referring to the drawings in detail, 1 indicates a casing having a cover plate 2. The casing 1 is provided with an aperture 3 and a sleeve 4 to which is connected a conduit 5 for receiving the electric cable. The casing is also provided with an annular rearward extension 6 having a passageway 7. This extension is embraced by a collar 8 which is fastened by the ears 9 and screws 10 to the wall 11 of the stack. Interposed between this collar 8 and the sleeve 6 is a guard sleeve 12 which extends into the stack in the path of the flue gases. The sleeve 12, the collar 8 and the sleeve 6 are held in engagement with one another by the set screw 13.

The sleeve 12 is so arranged that its upper half is cut away as at 14 leaving the thermostatic element 15 exposed but below the thermostatic element in the path of the incoming gases, this protecting sleeve is integral as at 16 so that soot and other foreign material will not be deposited on the thermostatic element 15 impeding its movement.

The thermostatic element is connected by the screw 17 to one end of the shaft 18. Its other end is connected by the screw 19 to a fixed abutment sleeve 20 that is held rigidly in position within the collar 6 by the set screw 21. 22 indicates a sealing disk around the inner end of the shaft at 23. The inner end of the shaft is mounted within the hub 24 of the rotating disk 25 that acts as a carrier for the running contact elements and other associated parts. A set screw

tains the hub 24 on the inner end of the casing 23.

Freely mounted upon this hub 24 is a rotating lever 27, the upper end of which is turned over at 28 to form a pointer with respect to the scale on the face of the supporting plate 25 behind which the lever 27 is located. The lower end of this lever extends forwardly beneath the plate 25 as at 29, to form a support for one of the running contacts, the function of which is hereinafter described.

The mercury contact member 30 is mounted within the spring fingers 31 upon the arm 29 and is retained in such position by the set screws 32 and washer 33 which retain the spring finger 31 upon the arm 29. This contact member is of the usual form consisting of a sealed glass tube having a quantity of mercury 34 therein and terminal wires 35 and 36 sealed in one end thereof.

It is also provided with a depending finger 37 fastened on one of the spring arms 31 and adapted to engage with a pin 38 on one of the spring arms 39 which support the starting contact member 40. By adjusting the position of the lever 27 the point at which the starting contact will be rotated by the rotation of the contact member 30 upon movement of the thermostatic element 15 will be determined. For instance, if the starting contact is to be thrown into inoperative position when the temperature is above 100 degrees, as indicated in Figure 1, then the rotation of the thermostatic element at and above that temperature will result in placing the starting contact in an inoperative position from which it cannot be moved until the finger button hereinafter described is operated.

The hub 24 carries the shaft 41 upon which is pivoted the spring arms 42 that carry one of the running contact members 43 provided with the usual quantity of mercury 44 and the terminal wires 45 and 46.

This spring arm construction is provided with a finger 47 that extends above the contact member and serves as a limiting stop between the two limiting pointers 48 and 49 which, in this instance, are set at 100 degrees and 300 degrees respectively, thus providing the temperature range through which these thermostatic controls operate in the stack and also provide the range of movement of the thermostatic element 43.

This finger 48 is mounted on the segment plate 50 which is provided with teeth 51 engaging with the teeth 52 of a pinion 53 which is actuated by the slotted stud 54. This stud and pinion are mounted upon the plate 25. Thus the adjustment of the position of the pointer 48 is effected.

The pointer 49 is mounted upon the segment plate 55 provided with teeth 56 engaging with the teeth 57 on the pinion 58 actuated by the stud 59 mounted on the plate 25. This plate controls the minimum temperature setting. Both of these plates are rotatable upon the shaft 41.

Thus, the contact-making member 43 rocks freely back and forth between the fingers 48 and 49 which determine the maximum temperature movement of this contact-making member and the range within which it operates while the lever 27 positioning the contact member 30 serves to determine the temperature at which the contact member 30 will shift the starting contact and above which the starting contact member 40 will be thrown into inoperative position, to which it can only be restored manually which necessitates the operator going to the stoker and restarting the fire

The starting contact member 40 is pivotally mounted through its spring arms 39 upon the shaft 60 that is in turn supported upon the bracket 61 formed as a part of the casing 1. This bracket 61 is provided on an upstanding finger portion 62 with a latch member 63 which has a nose 64 and a latching abutment or head 65. This head 65 is adapted to engage the shoulder 66 of the plunger 67 which is guided in its reciprocatory movement by the pin 68 slidably supported in the upstanding finger 62 of the bracket 61. A spring 69 is interposed between the shoulder 66 and the upstanding finger 62. The plunger 67 is guided by the sleeve 70 such sleeve 70 being mounted on the casing 1.

It will be noted that the contact members 43 and 30 are in series with the electrical circuit and contact member 40 is in parallel. 71 and 72 indicate the respective sides of the circuit connected to the motor of the stoker. The wire 71 is connected to the terminal 45 of the contact member 43. The wire 73 connects the terminals 46 and 35 of the contact members 43 and 30 respectively. The other terminal 36 of the contact member 30 is connected to the wire 72. The starting contact member which is connected in parallel across the line has its terminal 74 connected by the wire 75 to the wire 71, and its terminal 76 is connected by the wire 77 to the line 72.

Referring to the modifications shown in Figures 6, 7, 8 and 9, the plate 25 in this form is provided with a slot 80 through which the arm 29 moves and below this slot there are a plurality of teeth 81 in engagement with the teeth 82 of the pinion 83 which pinion is actuated by the shaft 84 and the hand wheel 85. A detent 86 having a nose 87 engaging the teeth 82 is actuated against the spring 88 by the finger piece 89.

In operation, when the device is moved by the reduction of the temperature to 100 degrees or below, it is enabled to do so without obstruction because the spring-controlled pawl or detent nose 87 is out of engagement with teeth 82. It will be noted that when the device has reached the position due to a temperature of 100 degrees or less (shown in Fig. 7) that contact member 30 is "open" and will remain "open" until reset manually.

Figure 8 shows the parts in starting position after having been reset by turning the knob 85 and manipulating the detent 86. As soon as fire is started and a temperature above 100 degrees is obtained in the smoke pipe, the device will assume its normal movement, due to the rising temperature, which releases the detent 86 and the spring 88 holds it out of engagement with teeth 82 so the device may function in the usual manner until such time as it becomes necessary to start a new fire.

Fig. 9 shows the position of device after the temperature has reached its upper limit and contact member 43 is "open" and the stack is cooling off.

In operation, when the device is moved by the reduction of the temperature to 100 degrees or below, it is enabled to do so without obstruction because the spring-pressed pawl or detent nose 87 is held away from the teeth 82. For starting purposes the apparatus is set as shown in

Figure 8. The pinion 83 and the detent 86 act as a means for rendering the thermostatic control within the stack ranges of 100 and 300 degrees inoperative.

In Figure 7 it will be noted that the parts are in position where the fire is out and hand starting is required by turning the knob 85 and manipulating the pawl or detent 86. Figure 8 shows the parts in starting position after having been reset by hand, and Figure 9 shows the parts in "off" position with the temperature up and with the stack starting to cool off.

*Operation*

Returning to the construction shown in Figures 1 to 5 and in Figure 10 and partially with respect to Figures 7 to 9, except as heretofore described, it will be understood that, in this apparatus, a thermostat in the room being heated by the boiler to which the stoker is attached will control through the electric circuit indicated the starting and stopping of the motor according to the temperature of that room, but where the temperature of the room falls below a certain temperature and the stack temperature falls below 300 degrees or any other arbitrary setting that may be desired, then if coal is not fed by the stoker for a considerable period the fire may go out. To take care of this condition, we have provided the two contact elements 43 and 30, which operate between some predetermined setting of temperature, such, for instance, as from 300 degrees down to 100 degrees in the stack. When the temperature gets down to 100 degrees, both of the contact-making members 43 and 35 are rotated by the thermostatic element 15 and the shaft 18 to the position shown in Figure 2, where the contacts are made by the position of the mercury and the respective contact members 43 and 30 and the motor is caused to start up on the stoker, which motor is connected to the lines 71 and 72 and coal is fed to the fire to prevent it from dying and this feeding continues until the temperature in the stack gets up to 300 degrees, at which point the parts will assume the position shown in Figure 3 with one or more of the contacts broken.

In the event that the fire has gone out and the contact-making elements get over to the position where the temperature is 100 degrees, the decreasing temperature, due to the fire being out and getting below 100 degrees, will cause further rotation of the disk 25 and lever 27 with the associated parts. The starting contact maker 40 having been thrown over backwardly by the finger 37 to remove the mercury from the contacts 74 and 76 into the position shown in Figures 2, 3 and 4 will remain in this position until shifted manually.

This occurs because the finger 37 has engaged the pin 38 and tilted the contact-making member for the starting contact 40 into its inoperative position in which it remains because of the fact that the push button 67 cannot push it into position due to the fact that the latch 65 is in the path of the push button 67. It will be noted that the heel 64 of this latch normally rests within a cut away portion of the plate 25 and against the shoulder of the cut away portion. When the plate 25 moves so as to engage through this shoulder the heel 64 it lifts the latch 65. As the contact maker 40 is in parallel with the circuit, the motor circuit may be made by a proper positioning of the maker 40 whereby the motor can start up and feed coal. For this purpose it is necessary for the operator to go to the boiler, start the fire, push the button 67 to restore the circuit by putting the contact-making member 40 into engaging position so that the mercury covers the terminals 74 and 76.

Before pushing the button, the parts are, as shown in Figure 4 where the latch has been lifted and the fire is out: upon pushing the button the parts are as in Figure 1 ready to start; and when the stoker gets into operation the parts will assume the positions shown in Figure 2, and, when the heat becomes considerable as up to 300 degrees and the circuit is cut off, the parts will assume the position shown in Figure 3, the contact-making member 43 having rotated from the position in Figure 2 over to the position in Figure 3.

In other words, Figure 2 is in the 300-degree position and the contact member 43 remains with its spring finger 47 against the pointer 48 while the disk 25 is traveling counterclockwise until the contact member 43 gets over dead center whereupon it suddenly rocks in a counterclockwise direction until its spring finger 47 is stopped by the finger 49. At this point the temperature is approaching 300 degrees. This gives a sudden make and break of the contact member 43. The lower contact member mounted on the lever 27 is set with respect to the plate 25 to determine the minimum temperature in the stack at which this thermostatic control will start up if there is still fire in the stoker. When the temperature in the stack starts to cool the reverse movement will take place.

In the forms shown in Figures 6, 7, 8 and 9 the starting contact member 40 is omitted, but the pinion 83 and pawl 86 are substituted for the purpose of preventing the contact members and their associated parts 43 and 30 operating if the temperature falls below some predetermined minimum, such temperature being that temperature or any temperature below it which would indicate that the fire was out.

It will be understood that when we refer to specific temperatures we are only doing this as a matter of illustration and that any desired setting may be secured. That is a matter of choice depending upon the conditions of operation of the apparatus.

For the purpose of illustration we have indicated in Figure 11 the boiler 90 having a stack 91 with a stoker 91 and a motor 92. 93 indicates an enclosure supplied with heat from the boiler to the radiator 94. The electrical circuit in which the motor is connected is provided with a room thermostat to open and close the circuit designated 95.

It will be understood that we desire to comprehend within our invention such modifications as may be necessary to adapt it to varying conditions and uses.

Having thus fully described our invention, what we claim as new and desire to secure by Letters Patent is:

1. In a thermostatic control, the combination of an electric circuit, a room thermostat, a motor controlled by said circuit for feeding coal to a furnace, a stack thermostat in the furnace stack connected in parallel to said circuit, and a plurality of means to render said parallel circuit inoperative, one of said means acting when the temperature in said stack falls below a predetermined point and another acting when said temperature rises above a predetermined point.

2. In a thermostatic control, the combination

of an electric circuit, a room thermostat, a motor controlled by said circuit for feeding coal to a furnace, a stack thermostat in the furnace stack connected in parallel to said circuit, and means to render said parallel circuit inoperative when the temperature in the stack falls below a predetermined value and when it rises above a predetermined value.

3. In a thermostatic control, the combination of an electric circuit, a room thermostat, a motor controlled by said circuit for feeding coal to a furnace, a stack thermostat in the furnace stack connected in parallel to said circuit, and means to render said parallel circuit inoperative when the temperature in the stack falls below a predetermined value.

4. In combination, in a temperature control apparatus, of an electric motor, means associated therewith for feeding fuel to a furnace, a thermostat affected by outgoing combustion gases from the furnace, said thermostat being so arranged that it may operate to close the motor circuit and operate said motor within a predetermined range of temperature in the fluid gases, and means to render said circuit inoperative when said fluid gases are reduced in temperature below a predetermined point or raised in temperature above a predetermined point.

5. In combination, in a temperature control apparatus, of an electric motor, means associated therewith for feeding fuel to a furnace, a thermostat affected by outgoing combustion gases from the furnace, said thermostat being so arranged that it may operate to close the motor circuit and operate said motor within a predetermined range of temperature in the fluid gases, and means to render said circuit inoperative when said fluid gases are reduced in temperature below a predetermined point.

6. In combination, in a temperature control apparatus, of an electric motor, means associated therewith for feeding fuel to a furnace, a thermostat affected by outgoing combustion gases from the furnace, said thermostat being so arranged that it may operate to close the motor circuit and operate said motor within a predetermined range of temperature in the fluid gases, means to render said circuit inoperative when said fluid gases are reduced in temperature below a predetermined point, and means to manually reclose said electric circuit.

7. In a thermostatic control apparatus, a thermostatic element, an electric circuit having a starting switch therein and regulating switches in parallel with the starting switch, means controlled by said electric circuit for varying the temperature applicable to said thermostat, and means in said thermostat to open the starting switch and to operate the regulating switches for starting and stopping the means for varying the temperature to the thermostat within predetermined ranges.

8. In a thermostatic control apparatus, a thermostatic element, an electric circuit having a starting switch therein and regulating switches in parallel with the starting switch, means controlled by said electric circuit for varying the temperature applicable to said thermostat, and means in said thermostat to open the starting switch and to operate the regulating switches for starting and stopping the means for varying the temperature to the thermostat within predetermined ranges, and means to close the starting switch independent of the thermostat.

9. In a thermostatic control apparatus, a thermostatic element, an electric circuit, means controlled by said electric circuit for varying the temperature applicable to said thermostat, means for starting the means for varying the temperature, means in said thermostat for cutting out the starting means and thereafter causing the starting and stopping of the means for varying the temperature to the thermostat within predetermined ranges, and means for resetting said starting means to again render it operative.

10. In combination in a temperature control for a furnace having a stack carrying fluid gases, a thermostatic element in said stack, an electric circuit, a motor for controlling the furnace temperature and controlled by the circuit, a contact member operable by said thermostatic element for opening and closing said circuit within a predetermined range of temperatures in said stack and a second contact member adapted to make and break said circuit operable by said thermostatic element to break the circuit when the temperature in said stack reaches a predetermined temperature.

11. In combination in a temperature control for a furnace having a stack carrying fluid gases, a thermostatic element in said stack, an electric circuit, a motor controlling the furnace temperature and controlled by the circuit, contact members operable by said thermostatic element for opening and closing said circuit, another contact member in parallel with the contact members, and manual means for closing said other contact member.

12. In combination in a temperature control for a furnace having a stack carrying fluid gases, a thermostatic element in said stack, an electric circuit, a motor controlling the furnace temperature and controlled by the circuit, contact members operable by said thermostatic element for opening and closing said circuit, another contact member in parallel with the contact members movable to a circuit breaking position by said thermostatic element, and means to manually reset said other contact member in a circuit making position.

13. In combination with an electric circuit including a motor for driving a stoker, a stack for conducting fluid gases from a furnace fed by the stoker, a thermostatic element in said stack, and a plurality of contact-making members connected into said circuit operable by said thermostatic element, one of said contact-making members arranged to open and close said circuit according to the temperature of the fluid gases within predetermined ranges, and another of said contacting members arranged to render said first mentioned contact-making member inoperative when the temperature in the stack reaches a predetermined point.

14. In combination with an electric circuit including a motor for driving a stoker, a stack for conducting fluid gases from a furnace fed by the stoker, a thermostatic element in said stack, a plurality of contact-making members connected into said circuit operable by said thermostatic element, one of said contact-making members arranged to open and close said circuit according to the temperature of the fluid gases within predetermined ranges, and another of said contacting members arranged to render said first mentioned contact-making member inoperative when the temperature in the stack reaches a predetermined point, and means for manually restoring said last mentioned contact-making mem-

ber to render said first contacting member operative.

15. In a heating system, the combination of means for supplying fuel for heating purposes, a control device for said means operable to prevent permanent cessation of operation of the system under substantially low heat requirement conditions, and a second control device arranged to discontinue the operation of said first mentioned control device when the fire is substantially extinguished.

16. A control system of the class described comprising, in combination, an electrically operated stoker, a heat responsive switch for operating the stoker when the temperature of the fire produced by the stoker falls below a predetermined degree, and a second switch for preventing operation of the stoker by the heat responsive switch if the fire becomes extinguished.

17. A control for a heating system embodying a furnace and means including a driving motor for supplying fuel to said furnace comprising, in combination, a motor circuit including a control device connected to said furnace and responsive to variations of fire conditions therein when the heating system is operating under low heat requirement conditions to prevent permanent cessation of operation of the system, and a second motor circuit connected in series with said first-mentioned circuit, said second circuit including a minimum temperature responsive device adapted to open said circuit when the fire is substantially extinguished.

18. In a heating system, the combination of means for supplying fuel for heating purposes, a control device for said means operable to prevent permanent cessation of operation of the system under substantially low heat requirement conditions, a second control device arranged to discontinue the operation of said first mentioned control device when the fire is substantially extinguished, and a thermostatic device responsive to a furnace condition for operating both of said control devices.

19. In a system of the class described, the combination of means for supplying fuel to a furnace, means responsive to an abnormal furnace condition for rendering said fuel supply means inoperative, and manual reset means for said last mentioned means whereby said fuel supply means may be rendered operative.

20. In a system of the class described, the combination of means for supplying fuel to a furnace, means responsive to an abnormal furnace condition for rendering said fuel supply means inoperative, and releasable manual reset means for said last mentioned means whereby said fuel supply means is rendered operative, said reset means being released when the furnace condition becomes normal.

21. In a system of the class described, the combination of means for supplying fuel to a furnace, switching mechanism in control of said fuel supplying means, condition responsive means responsive to an abnormally low furnace condition to move said switching mechanism to a circuit-breaking position whereby said fuel supplying means is rendered inoperative, and manual means for moving said switching mechanism to a circuit making position whereby said fuel supply means is rendered operative.

22. In a system of the class described, the combination of means for supplying fuel to a furnace, switching mechanism in control of said fuel supplying means, condition responsive means responsive to an abnormally low furnace condition to move said switching mechanism to a circuit-breaking position whereby said fuel supplying means is rendered inoperative, and releasable means for moving said switching mechanism to a circuit making position, said releasable means being released when said switching mechanism is maintained in a circuit making position by said condition responsive means.

23. In a system of the class described, the combination of means for supplying fuel to a furnace, switching mechanism in control of said fuel supplying means, condition responsive means responsive to an abnormally low furnace condition to move said switching mechanism to a circuit-breaking position whereby said fuel supplying means is rendered inoperative, a second switching mechanism in parallel with said first switching mechanism whereby said fuel supply means is rendered operative when said second switching mechanism is moved to a circuit making position.

24. In a system of the class described, the combination of means for supplying fuel to a furnace, switching mechanism in control of said fuel supplying means, condition responsive means responsive to an abnormally low furnace condition to move said switching mechanism to a circuit-breaking position whereby said fuel supplying means is rendered inoperative, a second switching mechanism in parallel with said first switching mechanism whereby said fuel supply means is rendered operative when said second switching mechanism is moved to a circuit making position, manual means for moving said second switching mechanism to a circuit making position, and means responsive to furnace conditions for moving said second switching mechanism to a circuit-breaking position.

25. In a system of the class described, the combination of means for supplying fuel to a furnace, switching mechanism in control of said fuel supplying means, condition responsive means responsive to an abnormally low furnace condition to move said switching mechanism to a circuit-breaking position whereby said fuel supplying means is rendered inoperative, a second switching mechanism in parallel with said first switching mechanism whereby said fuel supply means is rendered operative when said second switching mechanism is moved to a circuit making position, manual means for moving said second switching mechanism to a circuit making position and means operated by said condition responsive means for moving said second switching mechanism to a circuit-breaking position.

26. In a system of the class described, the combination of means for supplying fuel to a furnace, switching mechanism in control of said fuel supplying means, condition responsive means responsive to an abnormally low furnace condition to move said switching mechanism to a circuit-breaking position whereby said fuel supplying means is rendered inoperative, a second switching mechanism in parallel with said first switching mechanism whereby said fuel supply means is rendered operative when said second switching mechanism is moved to a circuit making position, manual means for moving said second switching mechanism to a circuit making position, means responsive to furnace conditions for moving said second switching mechanism to a circuit-breaking position, and means for preventing movement of said second

switching mechanism to a circuit making position when said furnace condition is normal.

27. In a system of the class described, the combination of means for supplying fuel to a furnace, switching mechanism in control of said fuel supplying means, condition responsive means responsive to an abnormally low furnace condition to move said switching mechanism to a circuit-breaking position whereby said fuel supplying means is rendered inoperative, a second switching mechanism in parallel with said first switching mechanism whereby said fuel supply means is rendered operative when said second switching mechanism is moved to a circuit making position, manual means for moving said second switching mechanism to a circuit making position, means operated by said condition responsive means for moving said second switching mechanism to a circuit-breaking position, and means operated by said condition responsive means for preventing movement of said second switching mechanism to a circuit making position when said furnace condition is normal.

28. In a heating system, the combination of means for supplying fuel for heating purposes, a control device for said means operable to prevent permanent cessation of operation of the system under substantially low heat requirement conditions, a second control device arranged to discontinue the operation of said first mentioned control device when the fire is substantially extinguished, and means to render said second control device inoperative to permit operation of said first mentioned device.

29. In a heating system, the combination of means for supplying fuel for heating purposes, a control device for said means operable to prevent permanent cessation of operation of the system under substantially low heat requirement conditions, a second control device arranged to discontinue the operation of said first mentioned control device when the fire is substantially extinguished, and means to render both of said control devices inoperative and cause operation of the fuel supplying means independently thereof.

30. In a heating system, the combination of means for supplying fuel for heating purposes, a control device for said means operable to prevent permanent cessation of operation of the system under substantially low heat requirement conditions, a second control device arranged to discontinue the operation of said first mentioned control device when the fire is substantially extinguished, means to render both of said control devices inoperative and cause operation of the fuel supplying means independently thereof and means for rendering said control devices operative when the fire is restored.

31. In a heating system, the combination of means for supplying fuel for heating purposes, a control device for said means operable to prevent permanent cessation of operation of the system under substantially low heat requirement conditions, a second control device arranged to discontinue the operation of said first mentioned control device when the fire is substantially extinguished, means to render said second control device inoperative to permit operation of said first mentioned device, and means for rendering said second control device operative when the fire is restored.

32. In a heating system embodying a furnace and means for supplying fuel to the furnace, the combination of a room thermostat, a furnace thermostat, and connections between the thermostats and the fuel supplying means to operate the fuel supplying means upon a demand for heat, to operate said fuel supplying means when the furnace temperature reaches a predetermined low value, and to prevent the last mentioned operation when the fire has become substantially extinguished.

33. In a heating system embodying a furnace and means for supplying fuel to the furnace, the combination of means for placing the fuel supplying means in operation upon a demand for heat, means for placing the fuel supplying means in operation when the furnace temperature reaches a predetermined low value, and means for preventing operation of said fuel supplying means by said last mentioned means when the furnace temperature reaches a predetermined lower value.

34. A control system of the class described, comprising, in combination, a fuel control device, a thermostat responsive to the heat produced by the burning of the fuel controlled by said fuel control device, control mechanism operated by the thermostat, connections between the control mechanism and fuel control device for preventing operation of the latter when the temperature to which said thermostat responds falls to a value indicating that the fire has become extinguished, means for manually latching said mechanism in a position to operate the fuel control device, and means for automatically unlatching said mechanism when the temperature at the thermostat rises to a value indicating that combustion has been restored whereby the control system is thereafter subject to automatic control.

35. In a heating system, the combination of electrically operated means for supplying fuel for heating purposes, a first switching mechanism for controlling said means to prevent permanent cessation of operation of said means under substantially low heat requirement conditions, and a second switching mechanism for preventing operation of said means when the fire is substantially extinguished.

JOHN R. BROWNELL.
CLARENCE B. LITTLE.

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Dec. 15, 1936. W. D. BURTON 2,064,194

HEATING SYSTEM CONTROL

Filed Nov. 13, 1930

Fig. 1

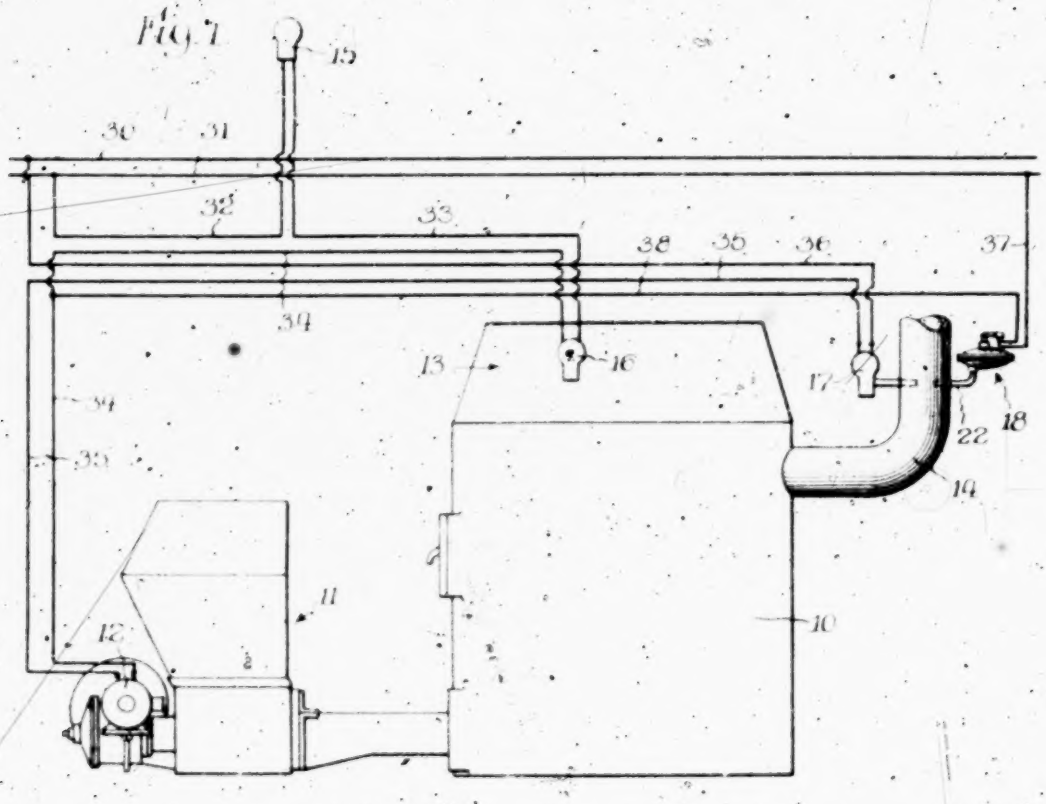
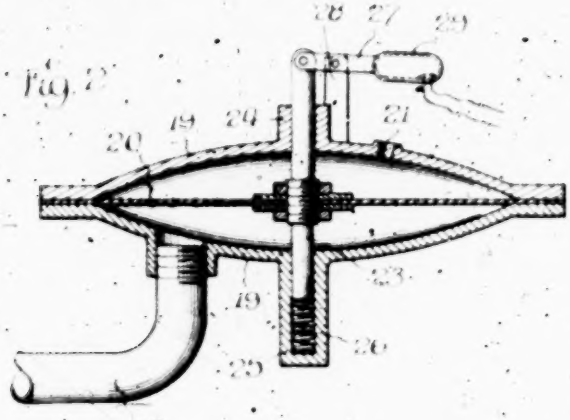



Fig. 2




Inventor
Warren Dean Burton,
By Chundell, Parker & Carlson
Attys.

Patented Dec. 15, 1936 2,064,194

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# UNITED STATES PATENT OFFICE

2,064,194

## HEATING SYSTEM CONTROL

Warren Dean Burton, Goshen, Ind., assignor, by mesne assignments, to Minneapolis-Honeywell Regulator Company, a corporation of Delaware

Application November 13, 1930, Serial No. 495,407

21 Claims. (Cl. 236—9)

The invention relates generally to heating system controls, and more particularly to a control for heating systems embodying automatic means for supplying fuel thereto.

An object of the invention is to provide a new

modifications and alternative constructions, I have shown in the drawing and will herein describe in detail the preferred embodiment, but it is to be understood that I do not thereby intend to limit the invention to the specific form

CERTIFICATE OF CORRECTION.

Patent No. 2,064,194. December 15, 1936.

WARREN DEAN BURTON.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, first column, line 63-64, claim 8, for the word "furnace" read space; line 66, same claim, for "responsible" read responsive; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 9th day of March, A. D. 1937.

Seal

Henry Van Arsdale
Acting Commissioner of Patents.

terrelated to control the operation of a fuel supplying means, while said low pressure responsive device circuit is operative independently of the maximum temperature device circuits to control the operation of the fuel supplying means and is inoperative when the low temperature device circuit is open.

Other objects and advantages will become apparent in the following description and from the accompanying drawing, in which:

Figure 1 is a diagrammatic plan and wiring diagram of a heating system embodying the features of the present invention.

Fig. 2 is a detail in central section of a pressure responsive device and its connection with the heating system.

While the invention is susceptible of various

ing and stopping operation of the stoker, when the heating system is operating at low heating requirements, to prevent the fire from becoming extinguished. These means are interconnected and associated for interrelated or independent control, as will hereinafter become apparent, in order to meet substantially any operating contingency which might arise.

In the illustrated embodiment, referring to Fig. 1, a thermostat 15, embodying switch contacts arranged to be open above a desired and predetermined room temperature, is located in any room or the like which is to be supplied with heat by the furnace 10. This thermostat controls the room temperature. A similar thermostat 16 also embodying switch contacts is

mounted in the compartment 13. The contacts controlled by the thermostat are separated when a maximum temperature within the compartment is reached, which temperature is, of course, determined by the requirements of the entire system, and is, in effect, a safeguard to prevent the furnace from becoming overheated.

A thermostat 17 is associated with the combustion chamber of the furnace, and in the present embodiment is mounted on the stack 14 to respond to temperature changes of the waste gases passing from the combustion chamber. The thermostat 17 embodies switch contacts separable at such a temperature of the exhaust gases as indicates that the fire in the furnace is out or nearly so. This device, therefore, controls the stoker motor to prevent operation of the stoker under such conditions that the supplied fuel would accumulate unburned in the fire box of the furnace.

When the heating system is operating under low heat requirement conditions, that is, when the stoker is operated only at irregular and long-spaced intervals, there is a possibility that the fire will become extinguished in the interval between stokings. Means, therefore, is provided, operating independently of the maximum temperature thermostats 15 and 16, to initiate operation of the stoker when the fire reaches a point at which it is in danger of becoming extinguished and to stop such operation when sufficient fuel has been added to hold the fire. This means is arranged to respond to fluctuations of conditions within the combustion chamber which are caused directly or indirectly by temperature variations, and in this embodiment is responsive to changes occurring within the stack 14. Preferably, a pressure responsive device, indicated generally at 18, connected to the stack 14, is employed.

Referring to Fig. 2, a suitable device of this character is illustrated as comprising opposed concave casing walls 19 marginally secured together with a diaphragm 20 traversing the chamber formed by the walls. One side of the diaphragm is vented to atmosphere through a port 21, and the other side thereof is in communication with the interior of the stack through a conduit 22. Axially, the diaphragm carries a pin or rod 23, one end of which is slidable through a bearing 24 in one wall. The other end of the pin 23 is seated in a closed bushing 25, a spring 26 being interposed between the end of the pin and the bushing for purposes of adjustment. The end of the rod which projects through the bearing 24 is pivotally connected to an arm 27 which, in turn, is pivotally supported by a bracket 28 rigid with the casing. The freely swinging end of the arm carries a mercury switch 29 of well-known construction.

In the passage of gas through a stack, the pressure within the stack depends largely upon the temperature of the gas. If the temperature is substantially equal to the atmospheric temperature, the pressure is likewise substantially equal to that of the atmosphere, and as the temperature of the gas increases the pressure within the stack varies inversely. Hence, the present device 18 is so connected to the stack that, as the pressure within the stack approaches atmospheric pressure (the diaphragm 20 moving accordingly to a substantially balanced condition), the mercury switch 29 is swung to establish a circuit therethrough. Inversely, as the temperature in the stack increases, the pressure decreases and the switch is swung by the diaphragm movement to open or break the circuit.

The control circuits will now be described. 30 and 31 indicate power supply lines or mains connected to any suitable source of current. The remote thermostat 15 is connected to line 31 by lead 32 and to adjacent thermostat 16 by lead 33. Thermostat 16, in turn, is connected by lead 34 to one side of the winding of the motor 12, the other side of which is connected by lead 35 to low temperature thermostat 17. Lead 36 between thermostat 17 and line 30 completes the circuit. The mercury switch 29 is connected by lead 37 to line 31 and by lead 38 to lead 34 between the thermostat 16 and motor 12.

It will be apparent that certain relationships of the controlling devices have been produced by these circuits. Thus, the remote and adjacent maximum temperature thermostats 15 and 16, and the minimum temperature thermostat 17, are connected in series with the motor, the thermostat 17 and the control device 18 are connected in series with the motor, and the thermostats 15 and 16 and the control device 18 are connected in parallel with the motor. In consequence, thermostats 15, 16 and 17 are interdependent in their control of motor operation, and confine the operating range of the motor between upper and lower limits of temperature. Thermostat 17 and control device 18 are also dependent and prevent the intermittent feeding operation of the motor (as governed by the device 18) from taking place when the fire is out. Control device 18 is independent of thermostats 15 and 16 whereby the intermittent fire replenishing feeding may occur as often as is necessary.

It will be evident from the foregoing that a novel control for a heating system has been provided which is capable of meeting substantially all operating contingencies. The temperature of a room may be maintained at a practically constant level. If, for any reason, the room temperature control fails to function, other controls prevent overheating of the furnace or, if the fire becomes extinguished, prevent further feeding of fuel. Independently, however, a further control intermittently causes fuel to be supplied to the furnace in order to hold the fire when low or substantially minimum temperatures are required, which last control is inoperative if the fire has already become extinguished.

I claim as my invention:

1. In a heating system, the combination of means for supplying fuel for heating purposes, and a pressure responsive control for said means actuated by a predetermined minimum pressure of the gaseous products of combustion to initiate operation of said fuel supplying means when said means is idle whereby to prevent permanent cessation of operation of the system when heat requirements are low.

2. In a heating system, the combination of a furnace having a stack, power driven means for supplying fuel to said furnace, and control means in said stack responsive to variations of pressure within said stack only to initiate or discontinue the operation of said fuel supplying means.

3. A control for a heating system embodying a furnace, a stack and means including a driving motor for supplying fuel to said furnace comprising, in combination, a pressure responsive device connected to said stack for operative movement according only to variations therein.

a make or break switch operable by the movements of said device, and a circuit including said switch and said motor.

4. A control for a heating system embodying a furnace and means including a driving motor for supplying fuel to said furnace comprising, in combination, a motor circuit including a control device connected to said furnace and responsive to variations of fire conditions therein when the heating system is operating under low heat requirement conditions to prevent permanent cessations of operation of the system, a second motor circuit connected in series with said first-mentioned circuit, said second circuit including a minimum temperature responsive device adapted to open said circuit when the fire is substantially extinguished, and a third circuit including one or more maximum temperature responsive devices connected in series and arranged to discontinue the operation of said motor when the temperature at said devices exceeds a predetermined point, said third circuit and said second circuit being connected in series and said third circuit and said first circuit being connected in parallel.

5. In a heating system, the combination of power-driven means for supplying fuel for heating purposes, a pressure responsive device disposed for operation by the pressure of the gaseous products of combustion, and control means for starting and stopping said power driven means operably connected with said pressure responsive device for actuation at a predetermined minimum pressure to initiate operation of said power driven means whereby to prevent permanent cessation of operation of the system when the system is only operating at infrequent intervals under minimum heat requirement conditions.

6. A system of the class described comprising, in combination, a coal stoker for heating a furnace, a device responsive to the temperature of the space to be heated thereby for operating said stoker when the temperature of the space to be heated falls below a predetermined minimum, and mechanism responsive to the temperature of the gases leaving the furnace for preventing operation of the stoker if the fire becomes extinguished.

7. A system of the class described comprising, in combination, a coal stoker for heating a furnace, a device responsive to the temperature of the space to be heated thereby for operating the stoker when said temperature falls below a predetermined minimum, means for operating the stoker under low heat requirement conditions to maintain the fire irrespective of the temperature of the space to be heated, and mechanism responsive to a furnace condition for preventing operation of the stoker if the fire becomes extinguished.

8. A system of the class described comprising, in combination, a coal stoker for heating a furnace, a device responsive to the temperature of the space to be heated thereby for operating the stoker, and mechanism responsible to the temperature of the products of combustion for preventing operation of the stoker by said device if the fire becomes extinguished.

9. A control system of the class described comprising, in combination, an electrically operated stoker for heating a furnace, a room thermostat normally in control thereof, a fire maintaining switch for operating the stoker to maintain the fire under low heat requirement conditions irrespective of the temperature at the room thermostat, a lock-out switch responsive to a furnace condition for preventing operation of the stoker if the furnace condition indicates that the fire has probably become extinguished, and means for returning the system to automatic control if the furnace condition returns to a point indicating that the fire was not extinguished without operation of the stoker.

10. A device for controlling a burner for heating a space with means for automatically stopping the burner when the fire gets too low, in combination with means to maintain a fire regardless of the temperature of the heated space, in combination with a means to prevent too hot a fire.

11. A device for controlling a burner for heating a space, with means to automatically stop the burner when the fire is too low to rekindle, in combination with means to maintain a fire regardless of temperature in the space heated, in combination with means to prevent too hot a fire, in combination with a thermostat in the space heated.

12. A device for controlling a burner for heating a space with means to automatically stop the burner when the fire is too low to rekindle, in combination with a thermostat in the space heated, in combination with a thermostatic regulator to operate the burner according to temperatures at the heat sensitive part of the regulator.

13. In a control system, in combination, an electrically operated stoker, and a circuit for controlling the same including a room thermostat and a fire maintaining switch in parallel and a lock-out switch in series with both the room thermostat and fire maintaining switch.

14. In a system for controlling the condition of a space having stoker means for supplying solid fuel to a furnace, the combination of means responsive to the condition of the space for controlling said fuel supplying means, means responsive to furnace conditions for preventing operation of the fuel supplying means if the furnace condition becomes abnormal, and means responsive to furnace conditions for preventing operation of the fuel supplying means if the fire becomes substantially extinguished.

15. In a system for controlling the temperature of a space, the combination of, stoker means for supplying solid fuel to a furnace, thermostatic means responsive to space temperatures, thermostatic means responsive to furnace temperatures, both of said thermostatic means controlling the operation of said fuel supplying means, and thermostatic means responsive to furnace temperatures for preventing operation of the fuel supplying means if the fire becomes substantially extinguished.

16. In a system for controlling the temperature of a space, the combination of, means for supplying fuel to a furnace, a pressure responsive control for said means actuated by a predetermined pressure of the gaseous products of combustion to initiate operation of said fuel supplying means, and thermostatic means responsive to the temperature of the furnace for preventing operation of the fuel supplying means if the fire becomes substantially extinguished.

17. In a system for controlling the condition of a space having stoker means for supplying solid fuel to a furnace, the combination of means responsive to the condition of the space for controlling said fuel supplying means, means responsive to the condition of the furnace for controlling the fuel supplying means independently

of the space condition responsive means, and means responsive to the condition of the furnace for preventing operation of the fuel supplying means by either of the condition responsive means if the fire becomes substantially extinguished.

18. In a system for controlling the temperature of a space, the combination of stoker means for supplying solid fuel to a furnace, thermostatic means responsive to space temperature for controlling said fuel supplying means, means responsive to the condition of the fire for controlling the fuel supplying means, and means responsive to furnace temperatures for preventing operation of said fuel supplying means by said thermostatic means or said fire condition responsive means if the fire becomes substantially extinguished.

19. In a system for controlling the temperature of a space, the combination of stoker means for supplying solid fuel to a furnace, thermostatic means responsive to space temperatures, thermostatic means responsive to furnace temperatures, means responsive to the condition of the fire, said thermostatic means and said responsive means being so arranged as to control the fuel supplying means, and thermostatic means responsive to furnace temperatures for preventing operation of said fuel supplying means if the fire becomes substantially extinguished.

20. In a system for controlling the condition of a space having stoker means for supplying solid fuel to a furnace, the combination of means responsive to the condition of the space for controlling said fuel supplying means, means responsive to the condition of the furnace for controlling the fuel supplying means independently of the space condition responsive means, means responsive to the condition of the furnace for preventing operation of the fuel supplying means by either of the condition responsive means if the fire becomes substantially extinguished, and means responsive to furnace conditions for preventing operation of said fuel supplying means by said space condition responsive means.

21. In a system for controlling the temperature of a space, the combination of stoker means for supplying solid fuel to a furnace, thermostatic means responsive to space temperature for controlling said fuel supplying means, means responsive to the condition of the fire for controlling the fuel supplying means, means responsive to furnace temperatures for preventing operation of said fuel supplying means by said thermostatic means or said fire condition responsive means if the fire becomes substantially extinguished, and means responsive to a predetermined furnace temperature for preventing operation of said fuel supplying means by said space thermostatic means.

WARREN DEAN BURTON.

FEEDING MECHANISM

Filed April 6, 1932 7 Sheets-Sheet 1

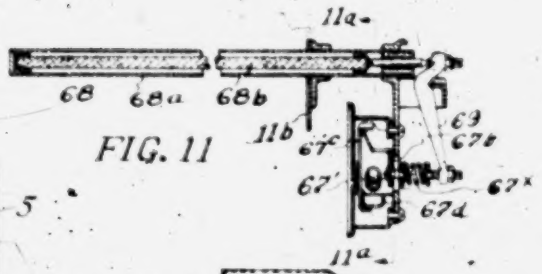


FIG. 11

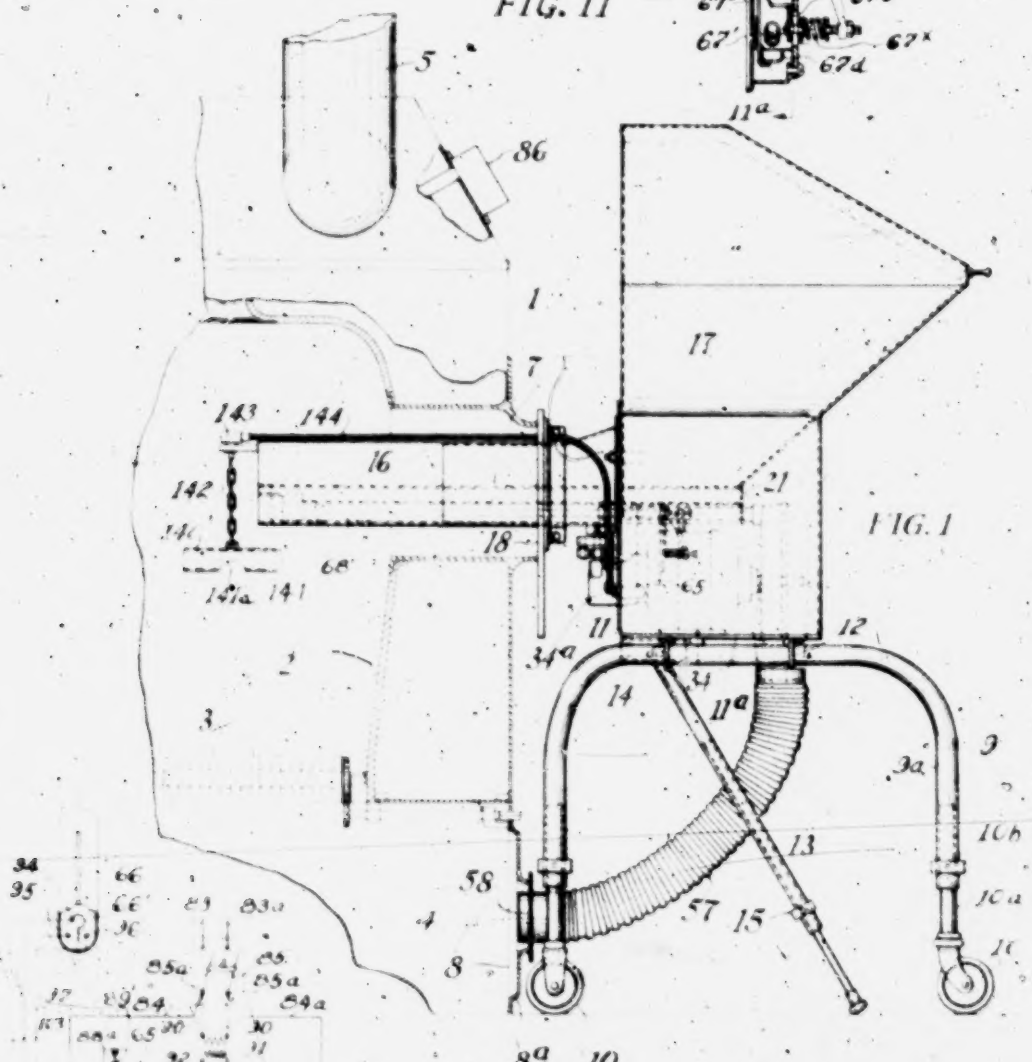


FIG. 1

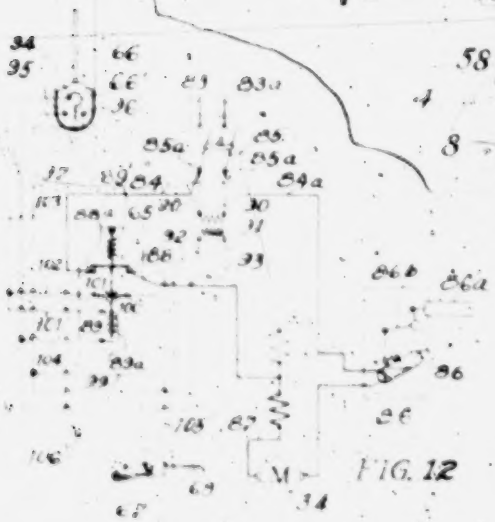


FIG. 12

FIG. 11a

INVENTOR

ATTORNEY

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March 1, 1938. M G BENJAMIN 2,109,939

FEEDING MECHANISM

Filed April 6, 1932 7 Sheets-Sheet 2

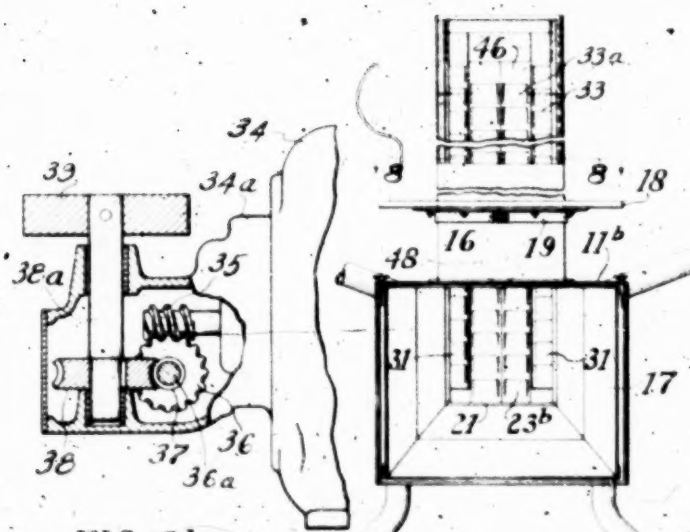



FIG. 9b

FIG. 3

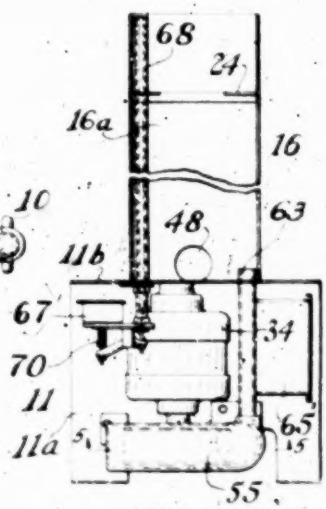
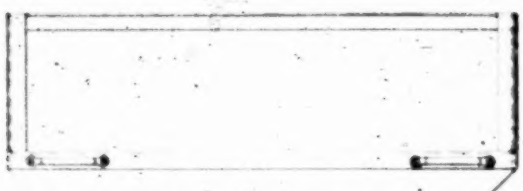



FIG. 4



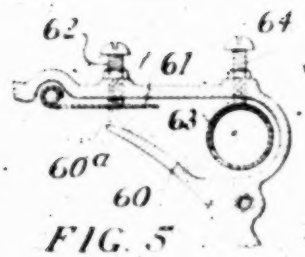




FIG. 5

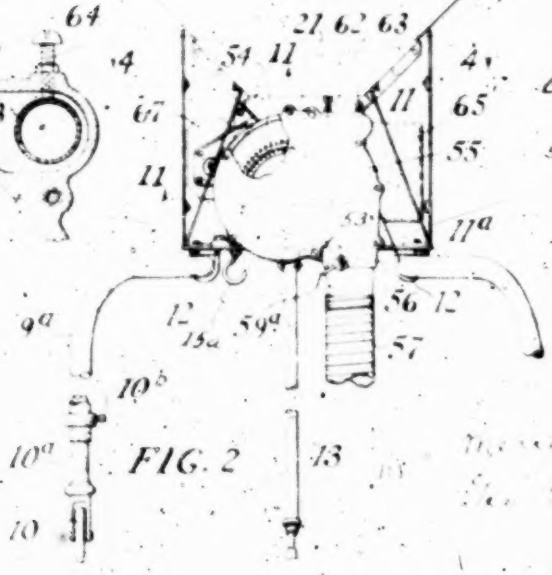



FIG. 2

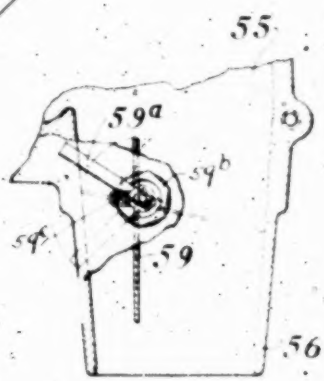



FIG. 6

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March 1, 1938. M. G. BENJAMIN 2,109,939

FEEDING MECHANISM

Filed April 6, 1932 7 Sheets-Sheet 3

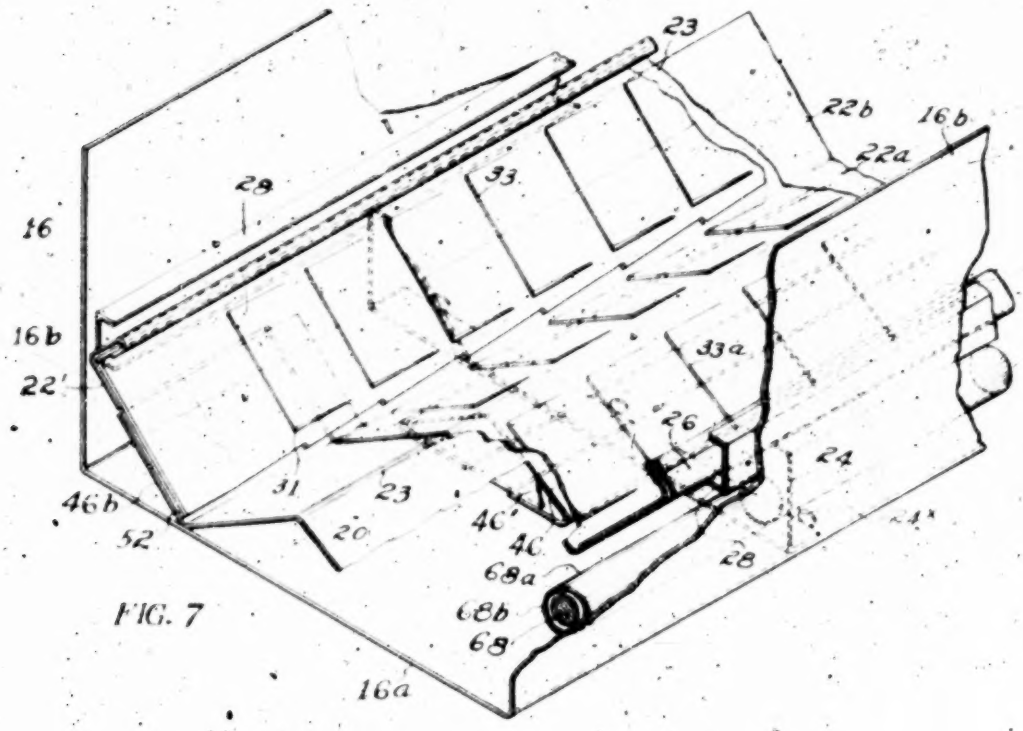
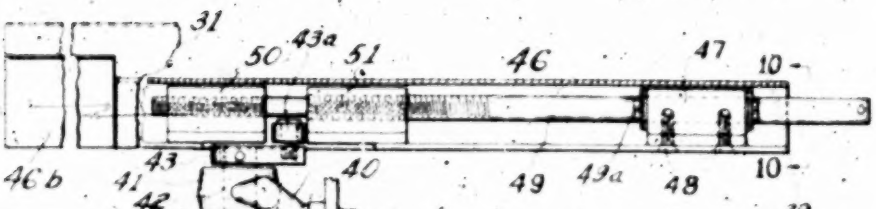



FIG. 7



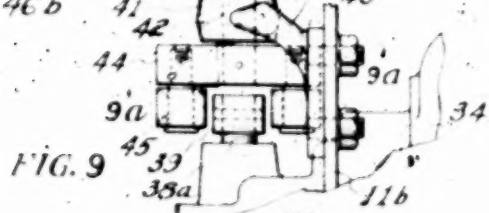




FIG. 9

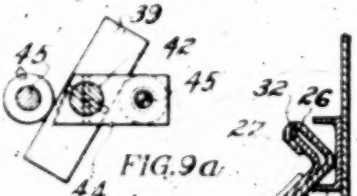



FIG. 9a

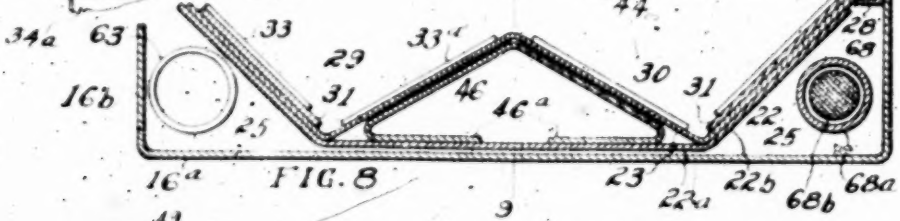



FIG. 8

FIG. 10

INVENTOR

Merrill G. Benjamin

BY H. C. Wills

ATTORNEY

870

March 1, 1938. M G BENJAMIN 2,109,939

FEEDING MECHANISM

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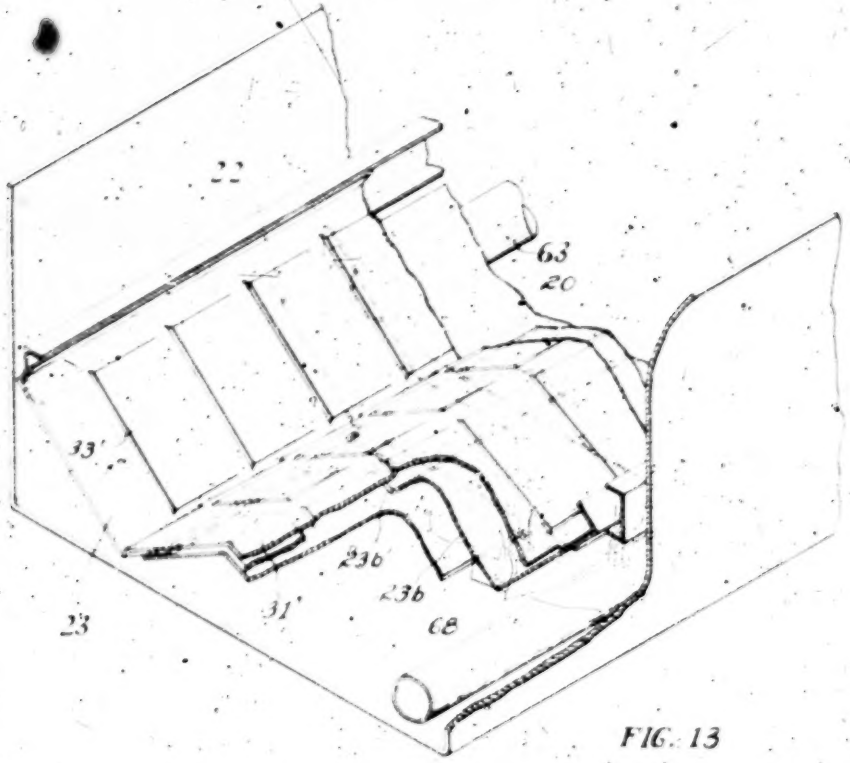


FIG. 13

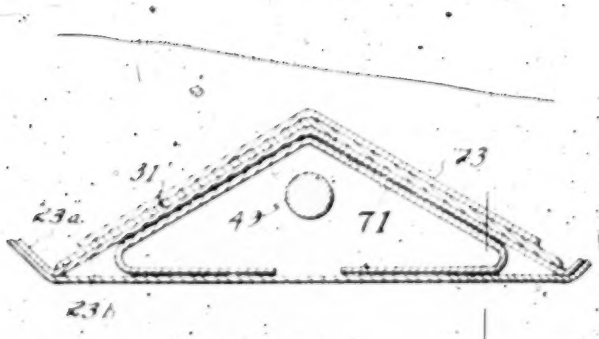


FIG. 14

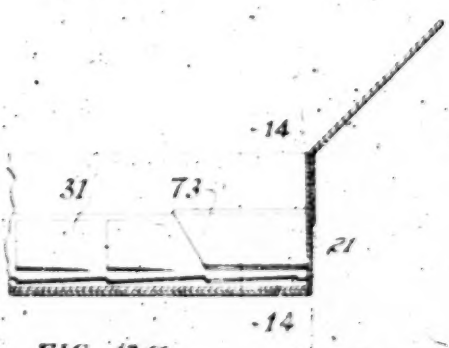


FIG. 13a

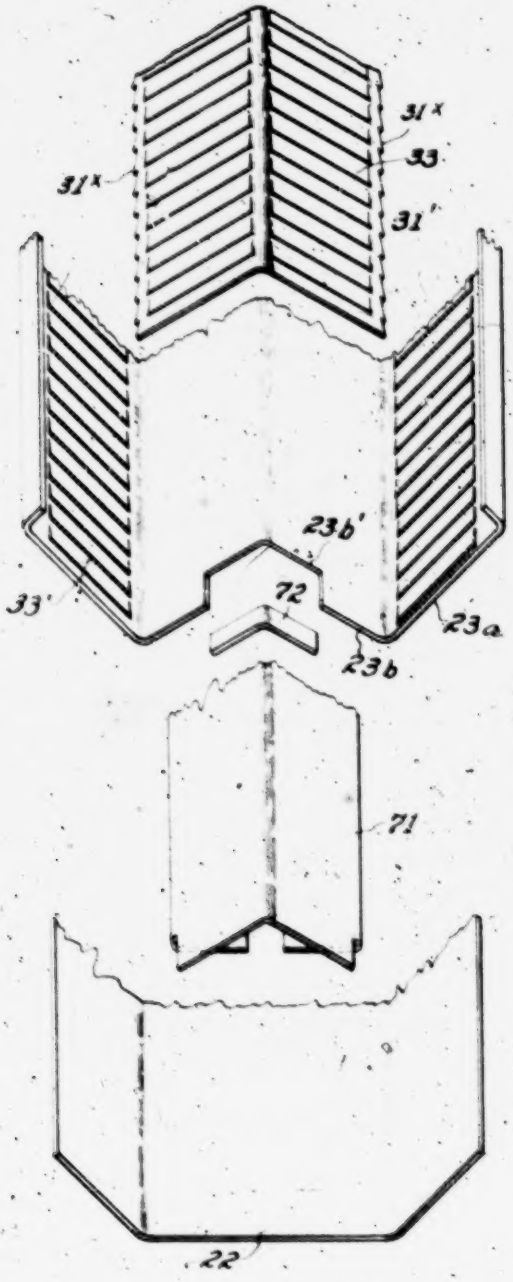


FIG. 15

INVENTOR
Merrill G Benjamin
BY
H. B. Wells
ATTORNEY

March 1, 1938. M. G. BENJAMIN 2,109,939

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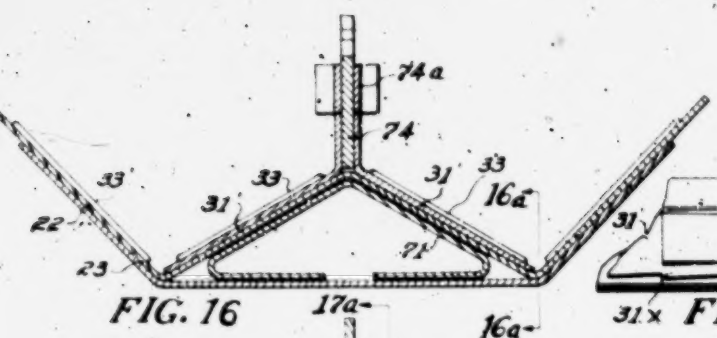


FIG. 16

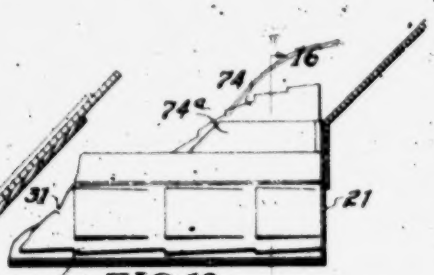


FIG. 16a

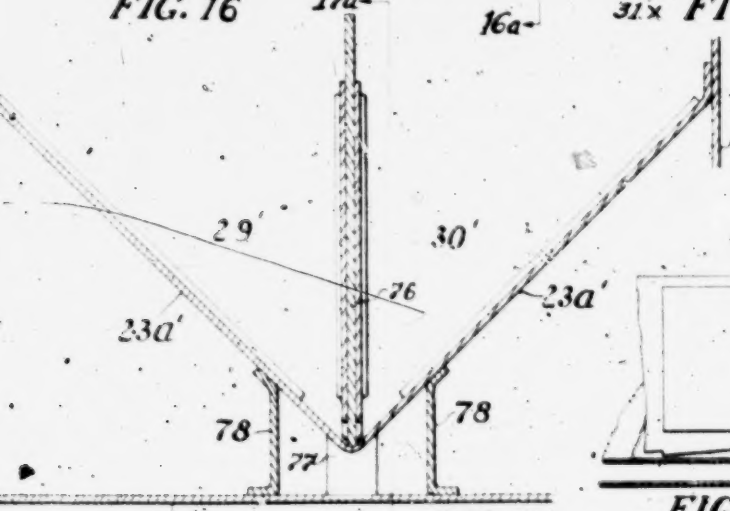


FIG. 17

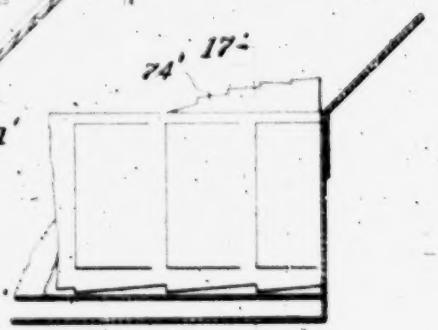


FIG. 17a

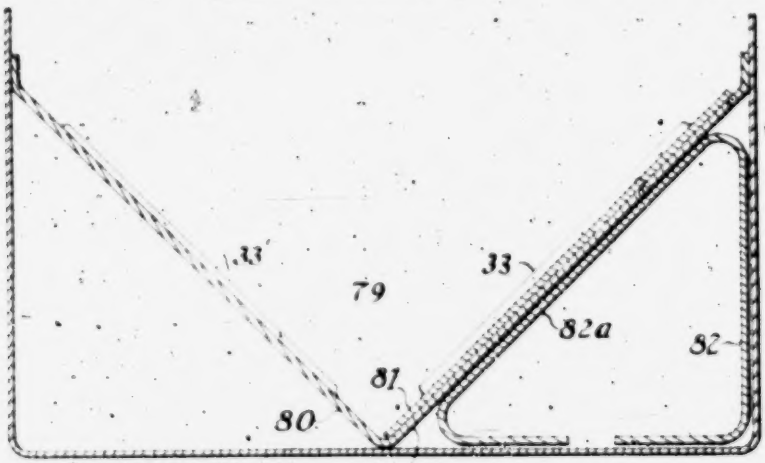


FIG. 18

INVENTOR
Merrill G. Benjamin
BY
Chas B. Pelle
ATTORNEY

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FIG. 19

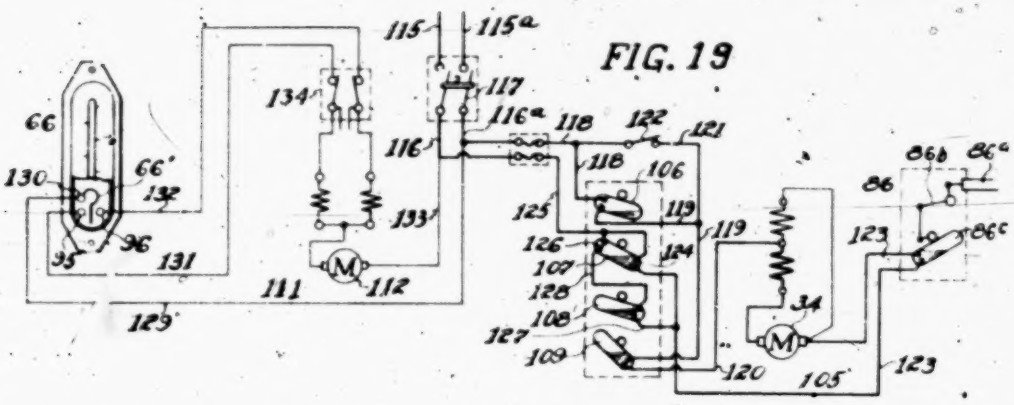



FIG. 20

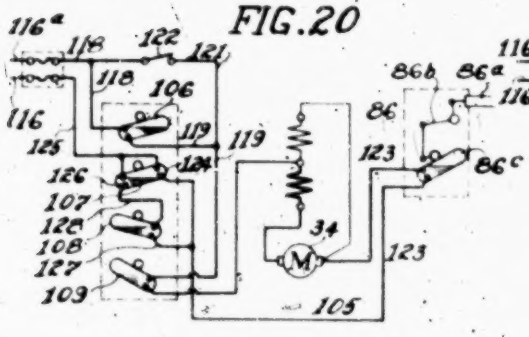



FIG. 21

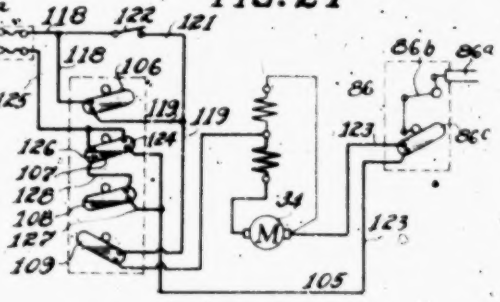



FIG. 22

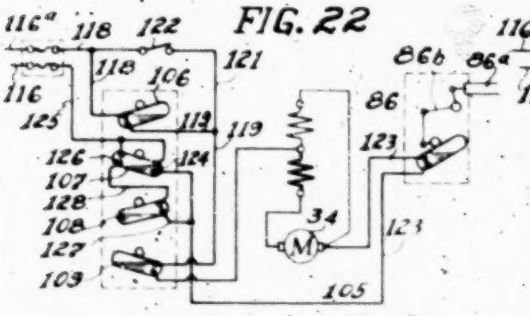



FIG. 23

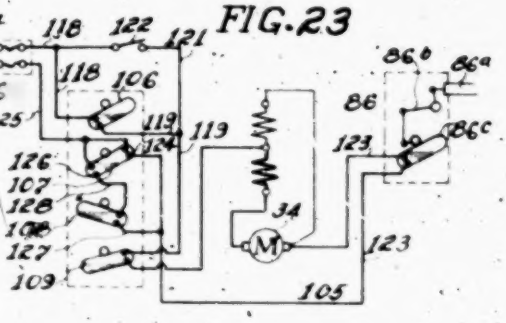



FIG. 25

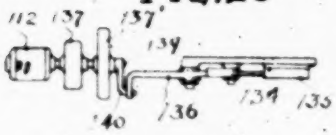
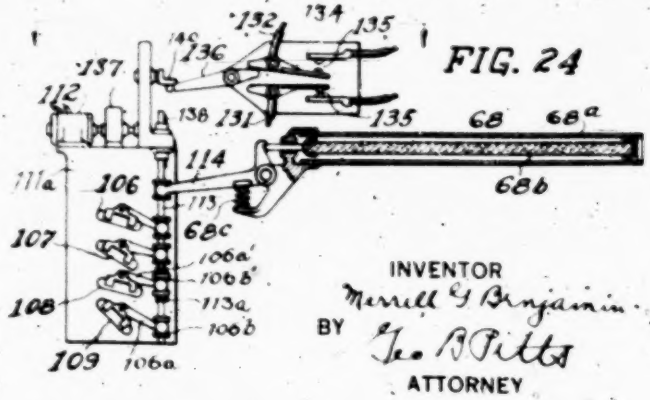



FIG. 24




INVENTOR
Merrill G Benjamin
BY Geo B Pitts
ATTORNEY

Patented Mar. 1, 1938

2,109,939

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# UNITED STATES PATENT OFFICE

2,109,939

## FEEDING MECHANISM

Merrill G. Benjamin, Lakewood, Ohio, assignor to Minneapolis-Honeywell Regulator Company, Minneapolis, Minn., a corporation of Delaware

Application April 6, 1932, Serial No. 603,653

18 Claims. (Cl. 236—15)

This invention relates to an apparatus for feeding material into a receiver, chamber or the like at a desired predetermined rate, whereby it may be used for (*a*) mixing materials in or fed to such receiver in desired proportions or (*b*) maintaining therein a substantially predetermined supply of the material where such material is being removed or discharged from the receiver or consumed therein. The invention also relates to a system for controlling the operation of a heating apparatus.

In the illustrated application of the invention, the receiver constitutes the fire box of a furnace or other heating apparatus and the material to be fed or delivered thereto comprises solid combustible fuel, for example, coal or coke (or a mixture thereof) in powdered or other forms (buckwheat, barley, nut or larger sizes), as desired; and in such application of the invention, it includes a system which is capable of (*a*) controlling and maintaining adequate combustion under varying load conditions and at a substantially predetermined temperature in the area to be heated when heat therein is required, and (*b*) cutting out the power means for the feed when abnormal conditions exist, namely, rise of temperature in the fire box above a predetermined degree, heating of the heat transfer medium above a predetermined temperature or pressure or extinguishment of the fire in the fire box.

One object of the invention is to provide an improved apparatus of this character capable of efficiently and automatically varying the rate of combustion of a fire bed in the fire box of a heating apparatus to compensate for changing conditions affecting the temperature in the area or areas to be heated, whereby such area or areas are maintained at substantially any desired temperature.

Another object of the invention is to provide an improved mechanism for feeding fuel to a fire bed at a rate substantially equal to the rate of combustion therein, whereby resulting gases are consumed or burned in the fire box and heat losses are avoided.

Another object of the invention is to provide an improved fuel feeding mechanism adaptable to man fired heating apparatus and capable of so placing the fuel in the fire box that maximum area of contact between the fire bed and heat absorbing surfaces of the fire box is obtained.

Another object of the invention is to provide a fuel feeding mechanism and to combine therewith an improved means for distributing the fuel to or upon the fire bed and for causing turbulence of the gases and air in the fire box, whereby oxygen is mixed with the gases and burned therewith and stratification of air and combustion gases in the fire box is prevented.

Another object of the invention is to provide an improved system or method of controlling combustion in the fire box of a heat producing unit or apparatus, whereby the maximum uniformity of combustion chamber conditions is maintained consistent with load conditions imposed on the apparatus and over travel or hunting of the system is eliminated.

Another object of the invention is to provide an improved fire bed fuel supply and control mechanism in which the fire is maintained in (*a*) active burning condition in accordance with changes in outside temperature conditions to insure a substantially uniform or fixed temperature in the area or areas to be heated and (*b*) a substantially inactive burning condition, when the temperature in the areas to be heated rises above a predetermined degree and so long as it remains thereabove, whereby a pilot fire results to insure active combustion when heat is required and fresh fuel is delivered to the fire bed.

Another object of the invention is to provide an improved apparatus of this character in which the feed of the material to a fire box may be effected substantially uniformly and in small quantities.

Another object of the invention is to provide an improved fuel feeding mechanism and to combine therewith control mechanisms which automatically maintain active combustion or a relatively low fire in the fire bed of a fire box to serve as a pilot, when active combustion is not required and automatically cuts out the power means for the feeding mechanism when abnormal conditions in the fire box exist.

Another object of the invention is to provide for a mechanism for feeding fuel to a fire box, a plurality of inter-related controls for said mechanism, certain thereof being actuated by the external temperature conditions and others thereof being actuated by the temperature existing in the fire box where abnormal conditions therein develop.

Another object of the invention is to provide an improved feeding mechanism having related devices which insure substantially uniform feeding of the material without danger of the material caking or clogging or affecting the operation of the mechanism.

Another object of the invention is to provide an improved mechanism for feeding fuel from

a hopper to a combustion chamber, such mechanism including a feed channel one wall of which reciprocates relative to another wall of the channel and serves to feed the fuel forwardly and to partially support the fuel while being fed, whereby uniformity of feed and discharge of the fuel into the combustion chamber results.

Another object of the invention is to provide an improved feeding mechanism that is relatively simple in construction, economical to manufacture and easy to assemble and also economical to operate and readily controlled.

Another object of the invention is to provide a unitary mechanism for feeding fuel and supplying air to a fire box of a heating apparatus below the fuel bed, whereby a sufficient draft is insured and adequate combustion maintained to effect efficient consumption of the fuel under varying temperature conditions.

A further object of the invention is to provide a portable, unitary fuel feeding and air supply mechanism readily adaptable to varying types of furnaces and other heating apparatus without alteration of the latter.

A still further object of the invention is to provide a fuel stoking mechanism having feed devices extending into the fire box of a heating apparatus and means for supplying air to the walls of said feed devices to prevent over-heating thereof without affecting fuel combustion in the box.

Other objects of the invention will be apparent to those skilled in the art to which my invention relates from the following description taken in connection with the accompanying drawings, wherein

Fig. 1 is a fragmentary view of a heating apparatus (partly in section) and a side elevation of a mechanism embodying my invention associated therewith in position to feed fuel into the fire box of such apparatus.

Fig. 2 is a front elevation of the mechanism, parts being broken away.

Fig. 3 is a plan view (certain detail parts being omitted).

Fig. 4 is a section on the line 4—4 of Fig. 2, with the feeding devices omitted.

Figs. 5 and 6 are fragmentary sectional views showing details of construction, taken on the line 5—5 of Fig. 4.

Fig. 7 is a fragmentary perspective view of the delivery end of the feed trough and feed devices, parts thereof being broken away to facilitate the illustration.

Fig. 8 is a section (enlarged) on the line 8—8 of Fig. 3.

Fig. 9 is a fragmentary section on the line 9—9 of Fig. 8.

Fig. 9a is a section on the line 9a—9a of Fig. 9.

Fig. 9b is a fragmentary view with parts broken away.

Fig. 10 is a section on the line 10—10 of Fig. 9.

Fig. 11 is a fragmentary section on the line 11—11 of Fig. 2.

Fig. 12 is a diagram of the circuits for one form of control means for the feed motor.

Fig. 13 is a view similar to Fig. 7, but showing a modified form of construction.

Fig. 13a is a fragmentary view of the inner end of the feed devices of the form shown in Fig. 13.

Fig. 14 is a section on the line 14—14 of Fig. 13a (enlarged).

Fig. 15 is a perspective view of certain of the parts shown in Fig. 13, but in separated relation.

Fig. 16 is a section showing a different form of feeding devices, being a section on the line 16—16 of Fig. 16a.

Fig. 16a is a side view of parts shown in Fig. 16.

Fig. 17 is a section showing another form of feeding devices, being a section on the line 17—17 of Fig. 17a.

Fig. 17a is a side view of parts shown in Fig. 17.

Fig. 18 is a section showing still another form of feeding devices.

Fig. 19 is a diagram showing a modified form control means and the circuits therefor.

Figs. 20, 21, 22 and 23 are fragmentary views of the circuits for the feed motor, but showing the positions the control switches occupy under varying temperature conditions to control the operation of the motor.

Fig. 24 is a view, partly diagrammatic, showing the connections between the fire box thermostat and the room thermostat controlled motor and the circuit controlling switches.

Fig. 25 is a plan view of certain portions of Fig. 24.

In the drawings, 1 indicates as an entirety a heating apparatus which may comprise a hot water or steam boiler, but which is illustrated, by way of example, in the form of a warm air furnace having a fire box 2, a grate 3, ash pit 4 and air drum from which flues 5 (only one being shown) lead to the areas (such as the rooms of a building) to be heated; the fire box 2 having a feed opening 7 and the ash pit 4 having an opening 8.

9 indicates as an entirety a support mounted on suitable rollers 10, which may be of the caster type. The support 9 preferably consists of a pair of inverted U-shaped members 9a formed of tubing, the open ends of which receive the shanks 10a of the mountings for the rollers 10. The shank for each roller mounting may be adjusted vertically in the adjacent tube and fixed in adjusted position by a set screw 10b. The legs of the U-members are bent laterally as shown in Fig. 3 to stabilize the mechanism. 11 indicates an angle plate, the horizontal portion 11a of which is rigidly secured to the U-members, as by clips 12, such portion serving to hold the U-members in rigid, spaced relation. 13 indicates a locking device adapted to hold the support and the mechanism carried thereby in operative relation to the heating apparatus 1, as shown in Fig. 1, the rollers 10 permitting the support to be readily rolled into and out of position and the locking device 13 serving to prevent it from moving away from the heating apparatus 1 due to any unevenness in the floor A or otherwise. Such locking device 13 is in the form of a prop, which eliminates the necessity of connecting the support to the heating apparatus 1.

The prop 13 comprises a member pivotally connected at its upper end to a U-clip 14 on the bottom 11a of the angle plate 11 and adapted to engage the floor A at its opposite end, as shown in Fig. 1. This member consists of two elements, preferably adapted to telescope, one within the other, whereby the member may be lengthened or shortened to suit varying conditions, the elements being fixed in adjusted relation by a set screw 15. The prop may be held in an inoperative position by a clip 15a.

16 indicates a spout connected at its inner end to the vertical portion 11b of the angle plate 11 and extending forwardly therefrom for projection through the fire box opening 7 into the fire box 2, as shown in Fig. 1. The spout is formed of

high heat resisting sheet metal. At its inner end the spout 16 is provided with flanges by which it is rigidly bolted or otherwise secured to the plate 11b. The spout forms an enclosed conduit for the fuel from a hopper 17 to the space inwardly of the opening 7 within the furnace 1 and a support for the fuel feeding devices to which reference will later be made. The inner end of the spout registers with an opening formed in the wall 11b through which the fuel is fed from the hopper 17. The spout 16 is preferably rectangular in cross section and comprises a bottom 16a, sides 16b and a top, but the latter preferably terminates inwardly of the outer or free end of the bottom and side walls forming the spout (see Fig. 3). The bottom, sides and top of the spout 16 form a support for an adjustable closure and shield 18, which is adapted to engage the walls of the opening 7 and close the space between these walls and the walls of the spout. In this connection it will be noted that when my mechanism is positioned (see Fig. 1), the door for the opening 7 is removed and the support 9 is positioned with the shield in engagement with the walls of the opening 7, so that it becomes a door, with the spout 16 extending therethrough, to close the opening. The closure 18 comprises a relatively thick asbestos board and extends downwardly below the opening to shield the operating mechanism and other parts from heat radiating from the furnace walls. The shield is provided on its outer face with a plurality of angle strips 19 which slidably engage the walls of the spout so as to permit adjustment of the shield inwardly and outwardly, relative to the outer or delivery end of the spout. The strips 19 may be adjustably fixed to the spout in any desired manner.

When so fixed, the delivery end of the spout will be in the desired relation to the center of the fire box 2 when the support 9 is moved into position with the shield 18 against the walls of the opening 7.

20 indicates a trough extending from a point near the delivery or outer end of the spout therethrough and the opening in the plate 11b to the hopper 17, the trough being connected with the discharge opening of the latter and closed at its inner end by a wall 21 (Figs. 1, 2 and 3). The trough comprises a bottom plate 22 having a horizontal section 22a disposed in spaced relation to the bottom 16a and upwardly inclined sides 22b, and an upper plate 23, preferably of W-shape in cross section, the lateral sides of which are parallel to and spot-welded to the sides 22b. The inner end of the plate 22 is connected to the wall 21 and its outer end is connected to a transverse upstanding wall 24 having a flange on which the plate section 22a rests, said flange being suitably secured to the bottom 16a of the spout 16; whereas the plate 23 extends from the wall 21 outwardly beyond the wall 24 (see Fig. 7), for a purpose later set forth, but the lateral edge portions of the plate 23 are extended, as shown at 22' to provide extended guides hereinafter referred to. The transverse plate 24 is cut away throughout its central portion, corresponding to the cross section of the plate 22. The plate 24 serves to close the space between the plates 22, 23, and adjacent walls 16a, 16b, of the spout 16, to prevent in-flow of heat and gases into the spout and out-flow of air therefrom. The lateral longitudinal edges of the plate 23 are bent inwardly, as shown at 26, at substantially right angles to the upwardly and outwardly inclined sides 23a and the free edges of the bent portions 26 are bent back thereon, as shown at 27, to form closed guides, for a purpose later set forth. 28 indicates channels secured to the side walls 16b and forming supports for the end portions of the sides 23a.

By forming the plate 23 into W-shape, it will be seen that I provide two parallel feeding channels 29, 30, for the fuel or material, leading from the hopper 17 substantially to the discharge end of the spout, each having inclined sides, and each closed along its bottom and connected together to form a closed space between their inner or adjoining sides, which space is utilized for the power operated elements to effect feed for the fuel, as will later appear. Each feed channel is thus formed of two walls which co-operate to support the fuel as it is fed from the hopper to the point of discharge. One side of each channel 29, 30, forms a guideway and support for a reciprocatable member, preferably extending from the wall 21 to the end of the spout 16, less the maximum travel of said member, whereby the fuel is progressively fed forwardly uniformly for discharge from the outer end of the spout 16. By mounting the reciprocating device on one wall of the channel, it partially supports the fuel during feed thereof. In the form of construction shown in Figs. 1, 3, 4, 7 and 8, the reciprocatable members (shown at 31) are mounted on the outer sides 23a of the channels 29, 30, and each comprises a sheet metal strip having a width substantially equal to the width of the side 23a, and provided along its outer longitudinal edge with a flange 32 which slides in the guideway formed between the adjacent walls 26, 27. Each member 31 is provided with material advancing elements 33 and the adjacent side 23b of the channel is provided with material retarding elements 33a. Each element 33, 33a, preferably comprises a transverse, up-standing rib, formed by offsetting the metal to form an active transverse face at substantially right angles to the surface of the metal, the rearward portion of the off-set metal section being inclined inwardly and merging with the surface of the metal, so that the fuel is fed forwardly on the stationary device by the elements 33 on the reciprocatable device without appreciable obstruction, but is held against rearward or retrograde movement during inward movement of the reciprocatable device by the elements 33a. In this arrangement of relatively movable sides for each channel, uniform supply of the fuel in small quantities to the fire bed is insured in the operation of the reciprocatable members 31, the effect of which is to provide an even and uniform active combustion in the fire bed of the furnace. In accordance with the operations of the mechanisms controlling such feeding mechanism (as later set forth), so that the resulting combustion consumes in the fire box substantially all of the resulting gases. Furthermore, in the arrangement described, the feeding members 31 co-act with the opposed walls 23b to keep the material concentrated in the channels while feeding it forwardly, so that feeding elements disposed centrally of the channels and movable with respect to their walls are eliminated. In other words, instead of providing in the central portions of the channels feeding devices which, in pushing the material forwardly, would tend to spread it over the sides of the channels, I reciprocate one side of the channel, the effect of which is to carry the fuel on one side and to roll or drag it along the other, stationary side, so that there is a tendency for the material to gravitate in the channel while being moved forwardly. In the preferred

arrangement shown, each channel comprises a stationary inclined side and a reciprocatable inclined side, so that the fuel is supported substantially equally on both these sides and accordingly there is a positive engagement between the reciprocatable feed member and the fuel. As these sides extend continuously from end to end of the spout, the same movement is simultaneously imparted to all portions of the fuel between the hopper and discharge end of the spout. By reason of this arrangement and operation, the feed of the fuel is progressive from end to end of the spout and danger of portions of the fuel accumulating into piles or masses and being pushed laterally over the sides of the channels or discharged as such into the fire box is substantially eliminated; also, a more even control of the fire bed is insured and accumulation of unburned gases is prevented, irrespective of the rate of speed of the feeding members. As each flange 32 slidably fits into the guide-way and the latter is closed by the wall 27, fuel dust and fuel particles cannot lodge in between the feeding member 31 and side 23a and affect its operation.

The means for reciprocating the members 31 comprise the following:

34 indicates an electric motor suitably fixed to the plate 11a. One end of the shaft for the motor 34 extends into a casing 34a (see Fig. 9b) and is provided with a worm 35 which is in mesh with a worm 36 on a horizontal shaft 36a, said shaft being suitably supported in the casing 34a. The shaft 36a is provided with a worm 37 which meshes with a worm gear 38 on a vertical shaft 38a, also suitably supported in the casing 34a, and carrying a crank 39, preferably comprising a cross member extending radially to either side of the shaft. The shaft 36a, in the preferred form of construction also drives a flexible shaft, as hereinafter set forth. 40 indicates a bracket fixed to the wall 11b (see Fig. 9) and supporting a bearing 41 for a shaft 42, disposed substantially axially of the shaft 38a. The shaft 42 carries on its upper end a crank 43 and on its lower end a cross member 44 extending radially of the shaft to opposite sides thereof, these parts being pinned to the shaft and preventing endwise movement thereof in its bearing 41. The outer ends of the member 44 carry depending pins 45 disposed in the path of movement of the crank 39 and are engaged by the opposite end portions of the latter to rotate the shaft 42, these parts thereby serving as a flexible connection between the shafts 38a and 42. By preference, the pins 45 are provided with rollers to reduce friction between them and the crank 39 and such rollers may be formed of rubber or provided with rubber peripheries to eliminate noise. 46 indicates a hollow bar, formed of sheet metal and preferably triangular in cross section, slidably fitting within the space between the sides 23b of the plate 23 and bottom section 22a of the plate 22, the outer end of the bar 46 being connected to the reciprocatable members 31, as later set forth. 47 indicates a block fitting within the bar 46 near its inner end and fixed thereto by a plurality of countersunk screws 48 (see Figs. 9 and 10). The block 47 is formed with a through opening for a rod 49, which is free to rotate in the opening but is fixed to the block against relative endwise movement by washers engaging its opposite ends and held by cotter pins 49a or other suitable devices. The inner end of the rod 49 is threaded through a pair of spaced nuts 50, 51, disposed upon opposite sides of the crank 43 and arranged to be engaged by the latter as it revolves to effect reciprocation of the rod 49 and through it, reciprocation of the bar 46. The threads on the rod 49 are right and left hand, so that by rotating the rod, the nuts 50, 51, may be adjusted toward or from each other, the effect of which is to increase or decrease the throw of the rod, in each revolution of the crank 43, within certain limits. The nuts 50, 51, are shaped to loosely slide within the bar 46, but are held against rotation by the walls thereof. The crank 43 is preferably provided with a hardened steel roller 43a to engage the nuts 50, 51, to reduce friction. The bottom wall 16a of the spout 16 is formed with an opening 48 (see Figs. 3 and 4) and the bottom walls of the bar 46 are cut away (see Fig. 9) to accommodate the crank 43.

To connect the bar 46 to the reciprocatable members 31, I slit the bottom walls 46a of the bar transversely at a point remote from their outer ends and bend the resulting sections 46b outwardly and upwardly into parallel relation with the outer end portions of the members 31 and position between such related parts spacers 52, to which the parts are spot-welded. As the spacers 52 are slightly thicker than the adjacent sides 23a, the sections 46b move in a plane outwardly of the walls 23a. By preference, the walls 46a are slit at such point rearwardly of the free end of the walls 23a that the sections 46b overlap these latter walls throughout the travel of the feed members 31 (as shown in Fig. 7) to prevent fuel from gravitating into the spout 16 rearwardly of the sections 46b. Also, by forming the bar 46 of triangular shape, its top walls 46b' and the outer end portions of the members 31 form continuations of the channels 29, 30, as the bar and members move outwardly and inwardly, to convey the material to the discharge end of the spout where it gravitates to the fuel bed. The bar 46 is closed by a plate 46' disposed rearwardly of the sections 46b (see Fig. 7). This wall 46' and the wall 24 serve to prevent circulation or escape of heat and gases inwardly through the spout 16.

53 indicates as an entirety means for supplying air under pressure to the ash pit 4 below the grate 2, and into the spout 16 rearward of the wall 24, such supply being in proportion to the speed of the motor 34 and feed of the material or fuel into the fire box. The supply means comprises a blower 54, preferably of the multi-blade type, suitably mounted in a casing 55, the shaft of the blower being connected to an extended end of the shaft of the motor 34, so that air is supplied only when the motor 34 is in operation. The casing 55 is provided with a main outlet 56 to which is connected one end of a flexible conduit 57, the opposite end thereof leading into and through a draft opening formed in the door 8a for the opening 8; the latter end of the conduit being provided with a plate 58 to close the draft opening around the conduit. The plate 58 may be detachably connected to the ash pit door 8a.

The outlet 56 is provided with a valve 59, suitably trunnioned on an off-set axis to rock, so that the pressure of the supplied air maintains it open when the blower is operating, but when the blower is stopped, a counterweight 59 closes the valve to prevent escape of gases from the ash pit, or flow of air thereinto by reason of any suction effect within the fire box.

The supply of air through the conduit 56 may be regulated by the following means: that end of

the rock shaft for the valve 59 adjacent the counterbalance 59a rotates in a tubular member 59b, which is threaded into a hollow boss provided on the wall of the conduit. The member 59b is provided on its outer end with a collar, the outer sides of which are flat to form tool engaging surfaces. At one side the collar is cut away to receive the arm constituting the counterbalance 59a, and one end wall of the cut away forms a stop, which is engaged by the arm 59a to limit the swing of the valve 59 to the open position; accordingly, by rotating the tubular member 59b in its supporting boss, the stop may be positioned to regulate or limit the swing of the valve 59. The tubular member 59b is held in its adjusted position by a set screw 59c.

The casing 55 is also provided with a lateral chamber 60 connected with the casing 55 by an opening or port 60a, which is normally closed by a gravity operating valve 61 and opened by the pressure of the air when the blower is set in operation. The movement of the valve 61 is regulated by a set screw 62, to control the supply of air to the chamber 60. The inner side wall of the chamber 60 is formed with an opening into which the inner end of a pipe 63 fits, such pipe being held in position therein by a set screw 64. The pipe 63 extends outwardly, through the wall 11b and into the adjacent space 25 (see Fig. 4) between the walls of the spout and side walls 22a. The outer end of the pipe 63 is open and supplies air into the spout 16 to maintain its walls and those of the trough relatively cool and for another reason to be later set forth. Such supplied air may escape through openings 24x formed in the spout wall 16a to the fire box for combustion purposes.

Figs. 13, 13a, 14 and 15 show a modified form of construction in which the reciprocatable feed members and stationary sides of the channels are reversed; that is, the walls 23a of the W-member 23 (which is mounted within the plate 22 as shown in Fig. 7) are provided with retarding elements 33' and the feed member having feed elements 33, for each channel slides on the adjacent wall 23b. In this arrangement the feed members, shown at 31', are integrally connected and straddle the walls 23b; also the central portion of the walls 23b at their outer ends are cut away, as shown at 23b' so that the outer end of the triangular bar 71 (which is similar to the bar 46 and operated by the motor 34 through the driving elements already referred to) may be connected through a spacer or plate 72 to the feed member 31', such cut-away affording a space for the plate 72 to move in; also, the side walls 23a may be extended to the outer end of the spout 16. The bar 71, plate 72 and members 31' are preferably spot-welded together. In this form of construction I provide a hood 73 for the rear or inner end of the feed members 31', the hood being secured to the wall 21 and overlying the feed members to prevent dust and particles of fuel lodging below or behind them.

The opposite longitudinal side edges of the members 31' are preferably provided with propelling elements 31x formed by cutting the edges inwardly to leave laterally projecting faces, the purpose of which is to feed forwardly dust and small particles of the fuel and prevent it accumulating in the bottom of the channel.

Figs. 16 and 16a show a construction similar to Figs. 13, 13a, 14 and 15, but in which the reciprocatable feed members 31' carry at their rear or inner ends and centrally between them an agitator 74 adapted to engage the fuel in the bottom of the hopper and prevent it from clogging on the one hand and on the other hand provide a more even gravitation of the fuel into the feed channels. The agitator 74 is guided between a pair of strips 74a having flanges spot-welded to the wall 21.

Figs. 17 and 17a show a construction in which the feed members are disposed adjacent to each other, as shown in Figs. 13 to 16a, inclusive, but are disposed vertically and secured (as by spot-welding) to the opposite faces of a reciprocatable plate 76, which, near the outer end of the spout 16' is connected to a block 77, operated similarly to the bar 46. The rear end portion of the plate 76 is provided with an agitator 74', similar to the agitator shown in Figs. 16 and 16a. In this form of construction, the outer sides of the feed channels 29', 30', are supported by the side walls of the spout 16' and plates 78 resting on the bottom thereof.

Fig. 18 shows a construction in which a single feed channel 79 is provided in the spout. In this construction, one inclined side 80 is provided with retarding elements 33' and the opposite or opposed inclined side 80a carries a reciprocatable feed member 81 provided with fuel advancing elements 33. Also, in this form of construction the operating bar, shown at 82 is mounted to reciprocate in the space below the wall 80a and is connected to the member 81, by providing a spacer between its inclined wall 82a and the member 81 and spot-welding these parts together, the wall 81 being cut away to receive the spacer and permitting it to reciprocate. The bar 82 is reciprocated similarly to the bar 46.

Combustion in the fire box may be maintained for an indefinite period of time due to the supply of fuel and air by the feeding or stoking mechanism, but preferably the combustion and supply of heat and air is automatically controlled. In one arrangement, shown in Fig. 12, I provide (a) a suitable control responsive to temperature changes in the area or areas to be heated, as such areas are affected by outside temperatures, whereby the feeding or stoking mechanism is operated and stopped in accordance with such temperature changes to maintain a substantially fixed temperature in such areas and (b) a suitable control responsive to the conditions within the fire box (when outside temperature permits), whereby the feeding or stoking mechanism is operated and stopped in accordance with such fire box temperature changes to maintain a substantially inactive fire bed which serves as a pilot.

In another arrangement, shown in Figs. 19 to 25, inclusive, I provide an operating system for the heating apparatus controlled by a thermostat located in the combustion chamber and responsive to the temperature therein, and including a room thermostat and a mechanism controlled thereby for regulating or adjusting the responsive action of the combustion chamber thermostat, whereby—as later set forth—the system controls the combustion or heat supply automatically and stops the fuel feed and air supply when abnormal conditions exist.

Referring to one form of control means diagrammatically shown in Fig. 12, the motor 34 is set in operation and stopped by switch means 65 under control of a thermostat 66, which is located in the area to be heated. The thermostat is adjustable to effect closing of a circuit of the switch means at any predetermined de-

gree, it preferably having an adjustment range from 50 to 90 degrees F. The thermostat 66 and its adjustment means may be of any desired construction, but is arranged to close a circuit upon the drop in temperature to that for which it is set and to break the circuit upon the rise of temperature approximately one degree. When the temperature in the area remains above that degree for which the thermostat 66 is set to effect closing of the motor circuit the feed mechanism remains idle and permits the fire in the fire bed to gradually die down or drop, with a corresponding drop in temperature of the gases or atmosphere in the fire chamber. To prevent extinguishment of the fire on the one hand and on the other hand, to maintain sufficient combustion in the fire bed to ignite fresh fuel in the event the thermostat 66, due to drop in the room temperature, operates the switch means 65, I provide for the automatic starting and stopping of the motor 34 to feed fuel to the fire box by a supplemental switch 67 (see Figs. 11, 11a) under the control of a thermostat 68, which extends through the other space 25 in the spout 16 and beyond the wall 24, so that its outer end is exposed to the radiant heat in the fire box. The thermostat 68 preferably comprises an outer tube 68a of copper (which has a relatively high co-efficient of expansion) and an inner member, for example a rod 68b form of carbon (which has a relatively low co-efficient of expansion). The inner end of the tube 68a is fixedly mounted in the wall 11b and is closed at its outer end. The rod 68b normally bears against the closed outer end of the tube 68a and moves inwardly under the influence of a spring (later referred to) with such end when the tube expands, but is moved outwardly by such end when the tube contracts. At its inner end, the rod 68b is arranged to actuate a lever 69, which in turn closes the switch 67 (as later set forth), these parts being so arranged that the switch 67 will close the circuit when the temperature in the fire box falls to or below approximately 150° F. and open the circuit when the temperature in the fire box rises to or above approximately 175°, that is, so long as the temperature in the fire box is above 150°, the tube 68a is pressed inwardly under the influence of its spring, but if the combustion in the fire bed drops so that the temperature in the fire box falls to or below approximately 150° F., then the tube 68a will contract sufficiently to cause endwise movement of the rod 68b, the effect of which is to close the switch 67 and set the motor 34 in operation, whereby fresh fuel and air will be supplied to the fire bed to maintain combustion therein. Upon rise in temperature of the atmosphere in the fire box to or above 175°, the thermostat 68 will open the motor circuit and effect stoppage of the motor. The switch 67 and thermostat 68 are inter-related to the switch means 65 and thermostat 66 for controlling it and so arranged and connected in the circuit for the motor 34 that the switch 67 automatically operates when the thermostat 66 is inoperative and is ineffective when the temperature conditions are such as to bring the thermostat 68 into operation.

The switch mechanism 65 is mounted in a casing 65 and the switch 67 is mounted in a casing 67' (see Figs. 2, 11 and 11a).

The thermostats 66 and 68 control the circuits for the motor 34 in the following manner: the supply mains are indicated at 83, 83a, and are connected by a double arm knife switch 85 through terminals 85a to leads 84, 84a. The lead 84a has interposed in it a safety switch 86, to which reference will later be made, and extends to one side of the motor 34. From the other side of the motor is a lead 87 connected to one contact (88) of an electro-magnetic switch 89, the other contact 88a of the switch being connected to the lead 84, so that when the switch 89 is closed by energization of the switch coil 89a (against the tension of a spring 89'), the circuit for the motor 34 is closed across the contacts 88, 88a. The coil 89a is energized and de-energized by the control of the following circuits by the thermostat 66.

90, 90, indicate leads connecting the terminals 85a with terminals of the primary winding of a transformer 91. The secondary winding of the transformer is connected to leads 92, 93. The thermostat 66 preferably comprises a bi-metal element 66' connected at its inner end to a main terminal 94. The free end of the thermo-element 66' is adapted, (a) when the surrounding temperature is above that at which the adjustment member thereof is set, to engage a terminal 95 which is connected to the lead 93 and (b) when the temperature falls below the predetermined set degree, to engage a terminal 96, which is connected to the lead 92.

99 is a lead connected to the lead 92 and the terminal 100 of a second switch 101 opened and closed by the magnetic switch 89 simultaneously with the opening and closing respectively of the circuit across the terminals 88, 88a, the other terminal of the switch 101 being connected by a lead 102 to a lead 103 which in turn is connected to the main terminal 94. The lead 103 is connected by lead 101' to one end of the winding 89a, the other end of the latter being connected by a lead 104 to the lead 93.

The switch 67 preferably comprises a mercoid tube 67a, the contacts of which are connected by leads 105', 106', to the contacts 88, 88a, respectively, and serves to complete the circuit for the motor 34 and set it in operation when and upon the drop of the temperature below that for which the thermostat 68 is set, as already set forth, with resulting feeding of the fuel to the combustion chamber or fire box.

The switch means 65 and switch 67 operate as follows: Assuming that the main switch 85 is closed, the thermostat 66 is set to operate when the temperature in the room where it is located drops to 68° F. and that such temperature is higher. Under these conditions, the thermo-element 66' will be in contact with contact 95. If the temperature drops to 68° F. the thermo-element 66' will swing into engagement with the terminal 96. This engagement completes a circuit through lead 92 to one side of the secondary winding of the transformer 91 and from the other side of the latter through lead 93, lead 104, winding 89a, lead 101' and lead 103 to the terminal 94. Such circuit will energize the coil 89a and effect closing of the motor circuit across terminals 88, 88a, thus setting the motor 34 in operation and also closing of the circuit across the switch 101. Accordingly, if the thermo-element 66' disengages the terminal 96 (due to rise in temperature) the circuit for the coil 89a will remain completed as follows: From one end of the secondary winding 91 through lead 92, lead 99, switch 101, lead 102, lead 103, load 101', coil 89a, lead 104 and lead 93 to the other end of the secondary winding. If the temperature continues to rise, then the thermo-element 66' will

engage terminal **95** and effect a short circuiting of the coil **85***a*, the effect of which is to de-energize the latter; whereupon the motor circuit across terminals **88**, **88***a*, will be broken, thus stopping the motor **34** and the supplemental circuit through switch **101** will be opened, so that the circuits cannot again be completed until the thermo-element **66'** again engages the terminal **96**.

The mercoid tube **67***a* is mounted in a cradle **67***e*, connected through multi-levers **67***b*, **67***c*, **67***d*, to the main lever **69**, one lever (**67***d*) being normally actuated in one direction by a spring **67'** and operating through the levers and lever **69** to move thermo-element **68***b* inwardly when the thermo-element **68***a* expands. **67***x* is a spring interposed between the levers **68** and **67***b* (see Fig. 11) and arranged to compensate for over travel of the thermo-element **68***b* outwardly and inwardly beyond the limits of movement of the lever **67***b*.

Figs. 19 to 25, inclusive, illustrate diagrammatically a system of control wherein (*a*) a substantially uniform temperature is maintained in the combustion chamber in accordance with the load conditions imposed on the system by means of a thermostat within the fire box or combustion chamber, which thermostat has an operative range from a minimum temperature condition capable of maintaining relatively low ignition of the fuel to a high temperature condition slightly below the point where damage might result to the stoking mechanism or heating apparatus and (*b*) the fuel feeding mechanism is stopped when the temperature in the fire box drops below the minimum ignition temperature condition above referred to, for any reason, for example, loss of ignition of the fuel through exhaustion of the fuel supply; such system also includes means controlled by a thermostat, actuated by the temperature in the area or room to be heated, for adjusting or regulating the action of the fire box thermostat, whereby the latter will maintain the combustion chamber temperature at that temperature necessary to maintain the desired temperature in the area or room to be heated. The room temperature control means is co-operatively related to the mechanism actuated by the fire box thermostat through a compensating or differential connection therewith, which connection provides an automatic adjustment for the fire box thermostat, whereby the latter becomes responsive to varying temperature conditions in the fire box to control the fuel feeding and air supply mechanism. Such control by the fire box thermostat maintains maximum uniformity of combustion chamber conditions and eliminates overtravel or hunting of the system.

The control means now being described, except the room thermostat and the power means immediately controlled thereby, may be mounted in the casing **67'**; and the power means may be mounted on the support **9**.

Referring to these views, **105** indicates a circuit for the motor **34** having four control switches **106**, **107**, **108** and **109** and an emergency or safety switch mechanism **86** already referred to. The operation of the switches **106**, **107**, **108** and **109** is controlled, as hereinafter set forth, by the thermostat **68**, the location and construction of which have already been described, but by means of the compensating connection (above referred to) for the switch **108**, this switch is adjustable into varying connected relations to the thermostat **68** by mechanism controlled by the room thermostat **66**, whereby the thermostat **68** will maintain maximum uniformity of combustion chamber conditions consistent with the heat required from time to time in the area to be heated and over-travel or hunting of the system will be eliminated. **111** indicates a supplemental circuit for a motor **112**, the operation of which adjusts the switch **108**, as later set forth, this circuit being completed or broken by the operation of thermostat **66**. Each of the switches **106**, **107**, **108** and **109** preferably consists of a mercury tube, swingably supported in a suitable manner on a plate or base **111***a* (see Fig. 24), which may form part of the casing **67'**, and having one pair of contacts, except the tube **107** which has two pairs of contacts, the purpose of which will later appear. **113** indicates a shaft which is moved endwise by mechanism actuated by the thermostat **68** and it is also rotated by mechanism driven by the motor **112** under control of the thermostat **66**. Each of the switches **106**, **107** and **109** is provided with an arm **106***a* having a bifurcated end fitting between the flanges of a collar **106***b*, which is fixed to the shaft so that when the latter is moved endwise, the adjacent switch is swung about its pivot to close or open a circuit as later set forth; whereas the arm **106***a'* for the switch **108** is pivotally connected to a collar **106***b'* operated by the endwise movement of the shaft **113**, the pivot connection serving to prevent rotation of the collar **106***b'*. The collar **106***b'* is threaded internally and engages threads **113***a* on the shaft **113**; and accordingly when the shaft **113** is rotated, the collar **106***b'* is moved endwise relative to the shaft **113**, the effect of which is to swing tube **108** about its pivot according to the direction of rotation of the shaft. Such adjustment of the tube **108** changes its relation to the thermostat **68**, so that the latter, in response to the temperature in the fire box, will close and open the motor circuit at different temperature limits, respectively, as compared to the limits before any such adjustment is made. Each operating mechanism for the shaft **113** may, in some instances cause operation of the switch **108** independently of the other mechanism, or both mechanisms may operate simultaneously to swing the switch in the same or opposite directions dependent upon temperature conditions affecting the thermostats **66** and **68** and the position of the latter at any moment. The shaft **113** is operated in endwise directions through a suitable multi-leverage **114** by the thermostat **68** to simultaneously swing or rock the switches, but the switches **106**, **107** and **109** bear different angular relations to each other, so that each is operated in accordance with the extent of thrust movement inwardly or outwardly of the inner thermo-element **68***b*. The switch **108** is similarly operated, but by means of the adjustment above referred to its position or angular relation varies from time to time for reasons which will later appear. The leverage **114** is shown diagrammatically as a single lever connected to the shaft **113** in the same manner as each of the arms **106***a*, the lever operating to move the shaft **113** downwardly when the thermo-element **68***a* contracts and the spring **68***c* acting through the lever to move the shaft **113** upwardly when the element **68***a* expands.

The tube (switch) **109** is actuated by the thermostat **68** to open the motor circuit when the temperature in the fire box rises to or above a predetermined degree, for example 1000° F. and

to close the circuit when the temperature falls therebelow, irrespective of the temperature of the room in which the thermostat 66 is located. That is, should the temperature in the fire box, due to the combustion of fuel therein, rise to an abnormal degree, for example 1000° F., the thermostat element 68a would expand and permit the element 68b to move inwardly (toward the right in Fig. 24) under the influence of the spring 68c, thereby swinging the tube 109 from the position shown in Figs. 19, 20, 21, 22 and 24 to the position shown in Fig. 23, in which position the circuit for the motor 34 would be broken; and upon the drop of the temperature, for example, to or below 975° F. the tube 109 would be rocked in the opposite direction and close the circuit. The tube (switch) 107 is actuated by the thermostat 68 to close the motor circuit when the temperature in the fire box drops to a predetermined degree, for example, 100° F. and to open the motor circuit upon the rise of the temperature to approximately 125° F., the purpose of this switch by control of the fuel feed mechanism being to maintain the minimum combustion conditions in the fire bed, when such combustion conditions are not controlled by the switch 108. Upon opening of the circuit by the switch 107, the circuit is closed to position the tube 108 operatively in the circuit.

The tube (switch) 108 is actuated by the thermostat 68 to control the operation of the fuel feed mechanism to maintain a substantially uniform temperature in the fire box according to demand for heat in the room; that is, the thermostat 68 operates to move endwise the shaft 113 which in turn rocks the switch 108 to open or close the motor circuit, but due to the adjustable connection between the tube 108 and shaft 113, the thermostat 68 serves to rock the switch 108 and effect opening and closing of the motor circuit in any position of adjustment of the tube 108 so that the action of the thermostat 68 is regulated to control the switch 108 in accordance with the varying loads imposed on the system at all times. For example, if the compensating connection for the switch 108 is set so that the thermostat 68 will operate the switch to circuit closing position at a temperature of 300° F., in the combustion chamber and open the circuit at 325° F., therein and heat is required in the room, thermostat 66 will set in operation the motor 112 which through the shaft 113 will adjust the switch arm 106a' downwardly on the shaft 113, so that thermostat 68 will operate the switch to close the circuit at a temperature of 325° F. in the combustion chamber and open the circuit at 350° F. therein. If heat is still required in the room, thermostat 66 will effect a further adjustment of the switch 108, so that thermostat 68 will be effective to close the circuit at a still higher temperature in the fire box for example, 350° F. and open the circuit at 375° F. These operations will continue until a balance results between the heat supplied and the heat required. When the heat supplied exceeds that required for the room, the thermostat 66 will effect operation of the motor 112 to rotate the shaft 113 in the opposite direction to adjust the switch arm 106a' upwardly, so that the thermostat 68 will rock the switch 108 to circuit closing position and to circuit opening position at respective lower temperatures in the combustion chamber. If the heat supplied still remains above that required in the room, the thermostat 66 will effect a further adjustment upwardly of the switch arm 106a', so that the thermostat 68 will rock the switch to the circuit closing and circuit opening positions only when the temperature in the combustion chamber reaches still lower degrees, respectively, these operations being repeated until a balance results between the heat supplied and the room temperature. The (switch) 106 is actuated by the thermostat 68, irrespective of the room temperature to open the circuit for the motor 34 in the event the temperature in the fire box drops to an abnormal degree, for example, 75° F. if the fire goes out, due to exhaustion of the fuel or for other reasons.

115, 115a, indicate the supply mains connected to leads 116, 116a, through a main switch 117. 118 indicates a lead extending from the lead 116a to one contact of the tube 106, the other contact of the tube being connected by a lead 119 to one contact of the tube 109 and the other contact of the latter tube being connected by a lead 120 to one side of the motor 34. 121 is a lead connecting the leads 118, 119, and having interposed in it a switch 122. The lead 121 upon the closing of the switch 122 completes the motor circuit when the switches 106, 107 and 108 are open, as at the time a fire is started in the fire box 2, but after the fire is started and the circuit is completed through one of the switches just mentioned, the switch 122 is opened. From the other side of the motor 34 is a lead 123 connected to one contact of one pair of contacts 124 for the tube 107, the other contact of the pair (124) being connected by a lead 125 to one contact of the other pair of contacts 126 and to the lead 116; the lead 123 is also connected by a branch lead 127 to one contact for the tube 108. The other contact for the tube 108 is connected by a lead 128 to the other contact 126.

The circuit 111 for the motor 112 consists of the following: 129 is a lead connecting the lead 116a with the terminal 130 to which thermo-element 66' of the thermostat 66 is connected. The free end of the thermo-element 66' is adapted to make contact with terminals 95, 96, connected by leads 131, 132, respectively, through reversely wound field coils for the motor 112 to one side thereof, whereby the motor is driven in one direction or the other accordingly as the thermo-element 66' contacts with one or the other terminal. The other side of the motor 112 is connected by a lead 133 to the lead 116. 134 is a limit switch mechanism having pairs of contacts 135, one pair of which is separated by a rocker 136 to stop the motor 112 after it has operated the switch to its extreme limit in one direction. The motor 112 operates through a suitable gear reduction enclosed in a casing 137 to drive, at relatively low speed, a gear within the gear case 137', which gear drives a pinion (also within the case 137') drivingly connected through a spline 138 to the shaft 113 to rotate it, while permitting the shaft to move endwise.

The gear which is within the casing 137' and driven through the gear reduction by the motor 112 also meshes with another gear (also in the casing 137') to drive a shaft 139, to which is connected a crank 140. The crank 140 is arranged in making one revolution in one direction to engage the rocker 136 (see Fig. 24) and open one pair of contacts to break the circuit for the motor 112. If the crank 140 is revolved one revolution in the opposite direction, it will engage the rocker 136 and open the circuit through the other pair of contacts. It will thus be seen that the pairs of contacts 135 will serve to limit the

operation of the motor 112 in either direction and thus limit the adjustment of the switch 108. Also, when one pair of contacts are disengaged, the circuit remains closed through the other pair of contacts upon closing of the circuit to operate the motor in the opposite direction.

*Operation.*—Fig. 19 shows the position of the tubes (switches) 106, 107, 108 and 109 when the fire in the fire box is out and main switch 117 is open. If the temperature of the room was below that at which the thermostat 66 is set to operate, and the main switch was closed, the motor 112 would operate to rock the tube 108 to the position shown in Figs. 19 and 24 and then stop due to operation of the limit switch as shown in this latter view; if the room temperature was above that at which the thermostat 66 is set to operate, the motor 112 would move the switch or tube 108 to its other position; accordingly it will be seen that when the fire is out, the tube 108 may occupy either of its extreme positions, whether the main switch is opened or closed.

Assuming that heat is required, the thermo-element 66' would be in engagement with the terminal 96 and upon the closing of the main switch 117, the motor 112 will rock the tube to the position shown in Figs. 19 and 24. The fire is kindled and the supplemental switch 122 is closed to set the motor 34 in operation, the motor circuit being traced as follows: lead 116*a*, lead 118, lead 121, lead 119, switch 109, and lead 120 to the motor 34 and from the motor through lead 123, switch contacts 124 of tube 107, lead 125 and lead 116. As soon as sufficient heat is generated to expand the thermo-element 68*a*, the switch 106 will close the circuit (see Fig. 20), so that the circuit will be completed through lead 119, switch 106 and lead 118 and switch 122 may be opened. As combustion in the fire box increases, further expansion of the thermo-element 68*a* will effect rocking of the tube (switch) 107 to the position shown in Fig. 20. The return motor circuit will then traverse lead 127, switch 108, lead 128, switch contacts 126 of tube 107, lead 125 to lead 126, and the motor 34 will continue to operate until the thermostat 68 actuates the tube 108 to the position shown in Fig. 21; the motor circuit will then be broken across the contacts of this tube. If the temperature in the room drops, the thermo-element will engage terminal 96, and operate the motor 112 which in turn will adjust the tube 108 to the position shown in Fig. 20 and the motor 34 will be started. If, however, the room temperature remained above that at which the thermostat 66 was set when additional heat was required, and the temperature in the fire box dropped to 100° F., the thermostat 68 would rock the tube 107 from the position shown in Fig. 21 to that shown in Fig. 22 and thus close the motor circuit; the return motor circuit would then traverse lead 123, contacts 124 of the tube 108, lead 125 and lead 116. Accordingly, it will be seen that the tube 107, through the pair of contacts 124, open and close the motor circuit when the thermostat 66 is inactive and the tube 108 is in open-circuit position, to maintain the minimum ignition condition in the fire box (see Figs. 21 and 22) and that the pair of contacts 126 of tube 107 position tube 108 in operative relation to the motor circuit when the temperature in the fire box is at or above that at which the circuit through the contacts 124 is open. The thermostat 66' makes contact with the terminals 95 to drive the motor 112 in one direction and with terminal 96 to drive the motor in the opposite direction. If the element 66' makes contact with one of these terminals and then disengages therefrom, the motor circuit is broken, so that the motor 112 is operated to adjust switch 108 only so long as thermo-element 66' is in contact with one of these terminals.

From the foregoing description it will be seen that the combustion chamber thermostat controls the operating switch 108 according to substantially predetermined conditions in the chamber dependent upon the adjustment of the switch 108 and that when the demand for heat or the load imposed on the apparatus increases or decreases, the room thermostat causes the adjustment of the switch 108, the effect of which is to re-establish or re-set the conditions to be maintained by the combustion chamber thermostat in the combustion chamber. The room thermostat therefore will cause gradual increased or decreased increments in the temperature to be maintained in the heating apparatus in accordance with the increments in the load, upwardly or downwardly, imposed on the apparatus.

The safety switch 86 comprises a thermostat 86*a* disposed so as to be affected by the heating medium, namely, air in the present disclosure, a leverage 86*b* and a mercoid tube 86*c* the contacts of which are interposed in the lead from one side of the motor 34 (lead 84*a* in Fig. 12 and lead 123 in Fig. 19).

As shown, the tube 86*b* is normally maintained in that position which closes the circuit, but should the heating medium in the heating apparatus rise to an abnormal degree, the thermostat 86*a* will swing the tube to its other position and thus break the motor circuit. Where the heating apparatus consists of a steam boiler the switch 86 would be of pressure type and operate to open the circuit for motor 34 at a predetermined pressure below the safe operating pressure of the boiler.

141 indicates as an entirety means related to the outer end of the spout 16 and in the path of the fuel as it is discharged therefrom for distributing it over the grate or fire bed instead of allowing it to pile up in the form of a cone, the purpose being to maintain a fire bed in contact with the heat absorbing surfaces or walls of the fire box. The means 141 may be disposed below the spout but suspended therefrom, and arranged to divert the falling fuel toward opposite sides of the fire box. In the preferred form of construction, I provide a device, supported centrally between its ends and provide means for rotating it, so that the fuel is engaged and impelled downwardly and outwardly in various directions, whereby a substantially uniform distribution of the fuel around the fire box results; also, I provide a device so constructed that the atmosphere in the fire box is stirred or mixed to insure turbulence and burning of the gases and the prevention of stratification. To effectively carry out these functions, the device comprises a section of piping 140' open from end to end and formed on its lower side with an opening 141*a*. The pipe section is pivoted centrally to the lower end of a flexible element, such as a chain 142. The upper end of the chain is connected to a gear in a gear box 143 and the gear meshes with a worm on the outer end of a flexible shaft 144. The inner end of the flexible shaft 144 is suitably geared to one end of the shaft 36*a*. The fuel in falling or discharging from the spout 16 is engaged by the rotating pipe section and diverted in lateral directions so that the fuel bed is built up in contact with the side

walls of the fire box and more or less distributed over the entire area of the box. The rotating pipe section serves also to induce a flow of the gases and oxygen in the fire box through the opening 141 and these gases and oxygen are discharged from the ends of the pipe section. As a result, a circulation of the atmosphere is effected and the gases resulting from combustion become mixed with any free oxygen, so that the gases are readily consumed in the fire box.

It will be noted that the thermostat 68 extends through the wall 24, so that the portion beyond the wall is exposed to the heat of the combustion chamber and the portion inwardly of the wall is exposed to the air supplied through pipe 63. The position of the wall 24 may be changed to expose a larger or smaller portion of the thermostat to the radiant heat from the combustion chamber; also, by adjustment of the valve 61 the amount of air delivered into the spout 16 may be regulated to vary the responsive action of the thermostat 68, whereby its range of operation, that is, the difference in temperatures between the closing and opening of the switch 106, may be varied.

To those skilled in the art to which my invention relates, many changes in construction and widely differing embodiments and applications of the invention will suggest themselves without departing from the spirit and scope of the invention. My disclosures and the description herein are purely illustrative and not intended to be in any sense limiting.

What I claim is:

1. In a heating system, the combination with a heating apparatus having a combustion chamber, of a spout extending into said chamber, means for feeding fuel through said spout, thermostatic controlled mechanisms for starting and stopping said feeding means, one of said mechanisms being controlled by the rise and fall of the temperature in the area to be heated by said apparatus and the other mechanism being controlled by the rise and fall of the temperature in said combustion chamber, the thermostat for the last mentioned mechanism being disposed in said spout whereby said last mentioned mechanism may be assembled with said heating apparatus as a unitary structure.

2. In a control mechanism for a heating apparatus having a power operated stoker or fuel feeding mechanism, the combination of a room thermostat, a switch for starting and stopping said mechanism, controlled by said thermostat, a plurality of separate switches, arranged to start and stop said mechanism, and a thermo-actuated device affected by temperature changes in the fire box of the heating apparatus and operatively connected to all of said switches for operating either one thereof dependent upon predetermined temperatures in the fire box, one of said separate switches being arranged to stop said mechanism in the event the fire in the fire box becomes substantially extinguished.

3. In a control mechanism for a heating apparatus having a power operated fuel feeding mechanism, of a switch for starting and stopping the feeding mechanism; a thermostat affected by changes in temperature in the fire box of the heating apparatus, operating mechanism between said thermostat and said switch for operating the latter, a thermostat in the space to be heated, and means controlled by the last mentioned thermostat for adjusting the said switch relative to said operating mechanism.

4. In mechanism of the class described, the combination with a heating apparatus having a fire box and a mechanism for feeding fuel to said box, said mechanism including an electric motor, of a circuit for said motor, a thermostat in said fire box, a switch in said circuit arranged to open and close said circuit, an adjustable connection between said switch and said thermostat, a thermostat affected by changes in temperature in the room to be heated, and means controlled by the last mentioned thermostat for adjusting said connection.

5. In mechanism of the class described, the combination with a heating apparatus having a fire box and a mechanism for feeding fuel to said box, said mechanism including an electric motor, of a circuit for said motor, a plurality of switches in said circuit, a thermostat within said heating apparatus and connected to said separate switches for operating them, respectively, dependent upon substantially predetermined temperatures in said apparatus, and means controlled by the temperature external to the fire box for adjusting the connection between said thermostat and one of said switches.

6. In apparatus of the class described, the combination with a heating apparatus having a combustion chamber and power means, including an electric motor, for feeding fuel thereto, of a circuit for said motor, a thermostat within said chamber, a plurality of switches in said circuit connected to and actuated by said thermostat, one switch arranged to close the circuit when the temperature in said chamber drops to a predetermined limit, another switch arranged to open said circuit when the temperature in said chamber rises to a predetermined limit, another switch arranged to operate between said limits, and means responsive to the demand for heat on said apparatus for adjusting the connection between the last mentioned switch and said thermostat.

7. The combination with a furnace, of an auxiliary machine and means for driving it, regulator means having a thermostat within said furnace for controlling said auxiliary machine to maintain substantially constant combustion conditions therein, a second regulator external to said furnace responding to the demand on the furnace, and means actuated by said second regulator to adjust said regulator means to maintain some other substantially constant conditions in accordance with the demand on the furnace.

8. A control system for a heat producing unit having interrelated control elements, one of which is in the space utilizing the heat produced and another is located in the combustion chamber of the heat producing unit and arranged that when the temperature in the combustion chamber is above or below predetermined limits the system is inoperative, a control device arranged to operate the heat producing unit at a constant low rate and another control device arranged to be operative between the low rate, the latter control device actuated by the first mentioned control element.

9. In a temperature control system having a furnace for heating a space, the combination of fuel supplying means for the furnace, means responsive to space temperatures for controlling said fuel supplying means, means responsive to furnace temperatures for controlling also said fuel supplying means, and means responsive to furnace temperatures for rendering both of said temperature responsive means inoperative when

the furnace temperature decreases to a predetermined low value or increases to a predetermined high value.

10. In a temperature control system for a furnace for supplying heating fluid to a space for heating the same, the combination of fuel supplying means for the furnace, means responsive to space temperatures for controlling said fuel supplying means, means responsive to furnace temperatures for controlling also said fuel supplying means, and means responsive to the condition of the heating fluid for rendering both of said temperature responsive means inoperative when the condition of the heating fluid becomes abnormal.

11. In a temperature control system for a furnace for supplying heating fluid to a space for heating the same, the combination of fuel supplying means for the furnace, means responsive to space temperatures for controlling said fuel supplying means, means responsive to furnace temperatures for controlling also said fuel supplying means, means responsive to the condition of the heating fluid for rendering both of said temperature responsive means inoperative when the condition of the heating fluid becomes abnormal, and means responsive to furnace temperatures for rendering both of said temperature responsive means inoperative when the furnace temperature becomes abnormally high or abnormally low.

12. In a temperature control system having a furnace for heating a space, the combination of means for supplying fuel to the furnace, means responsive to the temperature of the space and of the furnace for controlling said fuel supplying means, means responsive to furnace temperatures for controlling said fuel supplying means independently of said first temperature responsive means, and means responsive to furnace temperatures for preventing operation of said fuel supplying means when the fire becomes substantially extinguished.

13. In a temperature control system for a space having a furnace, the combination of, means for supplying fuel to the furnace, switching mechanism for said means, a thermostat responsive to furnace temperatures, adjustable connecting means between said thermostat and said switching mechanism, a space thermostat, slow acting, reversible motor means controlled by said space thermostat, and means operated by said motor means for adjusting said adjustable connecting means whereby said furnace in operated at a temperature which maintains a constant space temperature.

14. In a temperature control system for a space having a furnace, the combination of means for supplying fuel to the furnace, switching mechanism for said control means, means responsive to the condition of the furnace, adjustable connecting means between said condition responsive means and said switching mechanism, a space thermostat, and means controlled by said space thermostat for adjusting said adjustable connecting means.

15. In a control system of the class described, the combination of condition changing means, control means for said condition changing means, means responsive to the condition of said condition changing means, adjustable means between said condition responsive means and said control means, means responsive to the condition controlled by said condition changing means, and slow acting means operated by said last mentioned condition responsive means for adjusting said adjustable means.

16. In a control system of the class described, the combination of condition changing means, control means for said condition changing means, means responsive to the condition of said condition changing means, adjustable means between said condition responsive means and said control means, means responsive to the condition controlled by said condition changing means for mechanically adjusting said adjustable means.

17. In a temperature control system, the combination of heating means for a space, means responsive to the condition of the heating means for maintaining the condition thereof at a value which will maintain the space temperature at a normal value, and means responsive to the space temperature for mechanically adjusting the condition responsive means when the space temperature varies from normal to adjust the condition of the heating means to return the space temperature to normal, said condition responsive means responding to the adjusted condition of the heating means to maintain the condition of the heating means at the adjusted value whereby the space temperature is maintained at normal.

18. In a heating system having a solid fuel fired heating device for heating a space, the combination with means for supplying fuel to said device, of means responsive to the temperature of said space for controlling said fuel supplying means, means to operate said fuel supplying means sufficiently to maintain the fire alive during periods of low heat requirements of said space, and means responsive to the temperature of said fire for preventing operation of said fuel supplying means if the temperature of the fire either reaches a low point indicating extinguishment of the fire or reaches a high point indicating that the fire is too hot.

MERRILL G. BENJAMIN.

May 17, 1938. S. C. SHIPLEY 2,117,514

THERMOSTATIC SWITCHING MECHANISM

Original Filed April 20, 1932 2 Sheets-Sheet 1

Fig. 4.

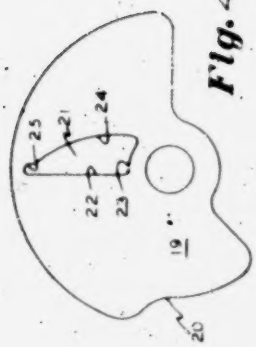


Fig. 3.

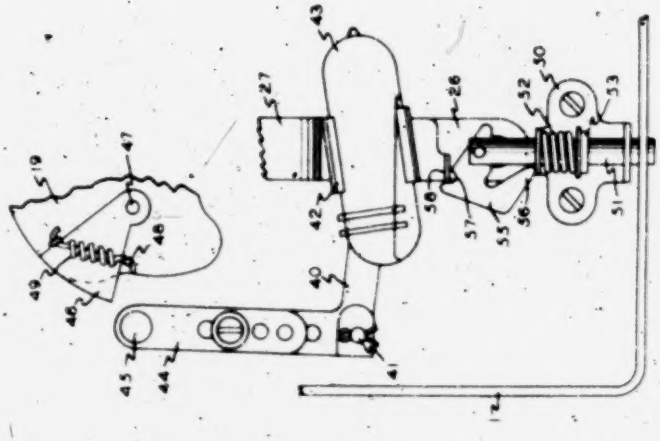
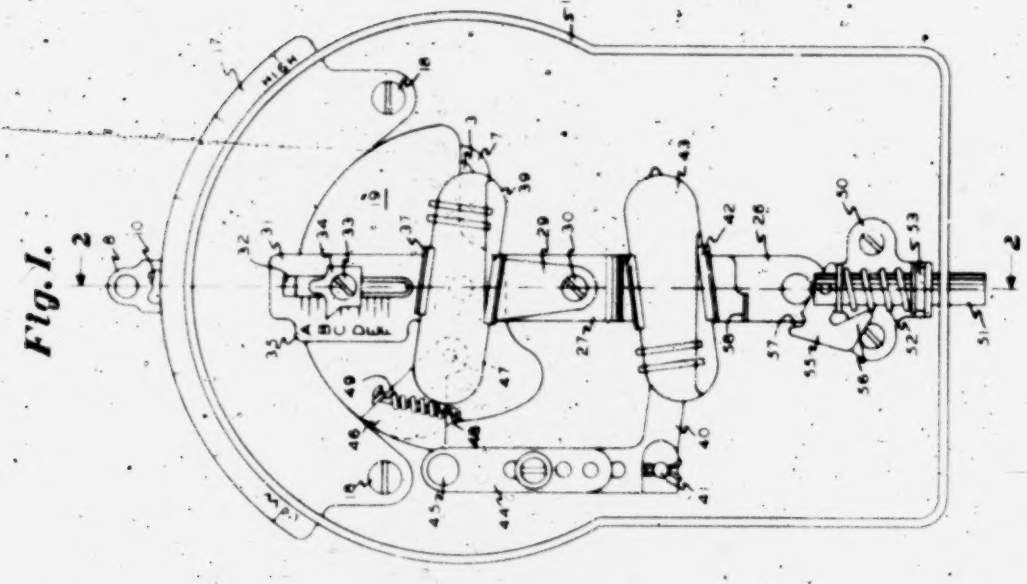


Fig. 1.



Inventor

Sylvanus C. Shipley

By George H. Fisher

Attorney

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THERMOSTATIC SWITCHING MECHANISM

Original Filed April 20, 1932 2 Sheets-Sheet 2

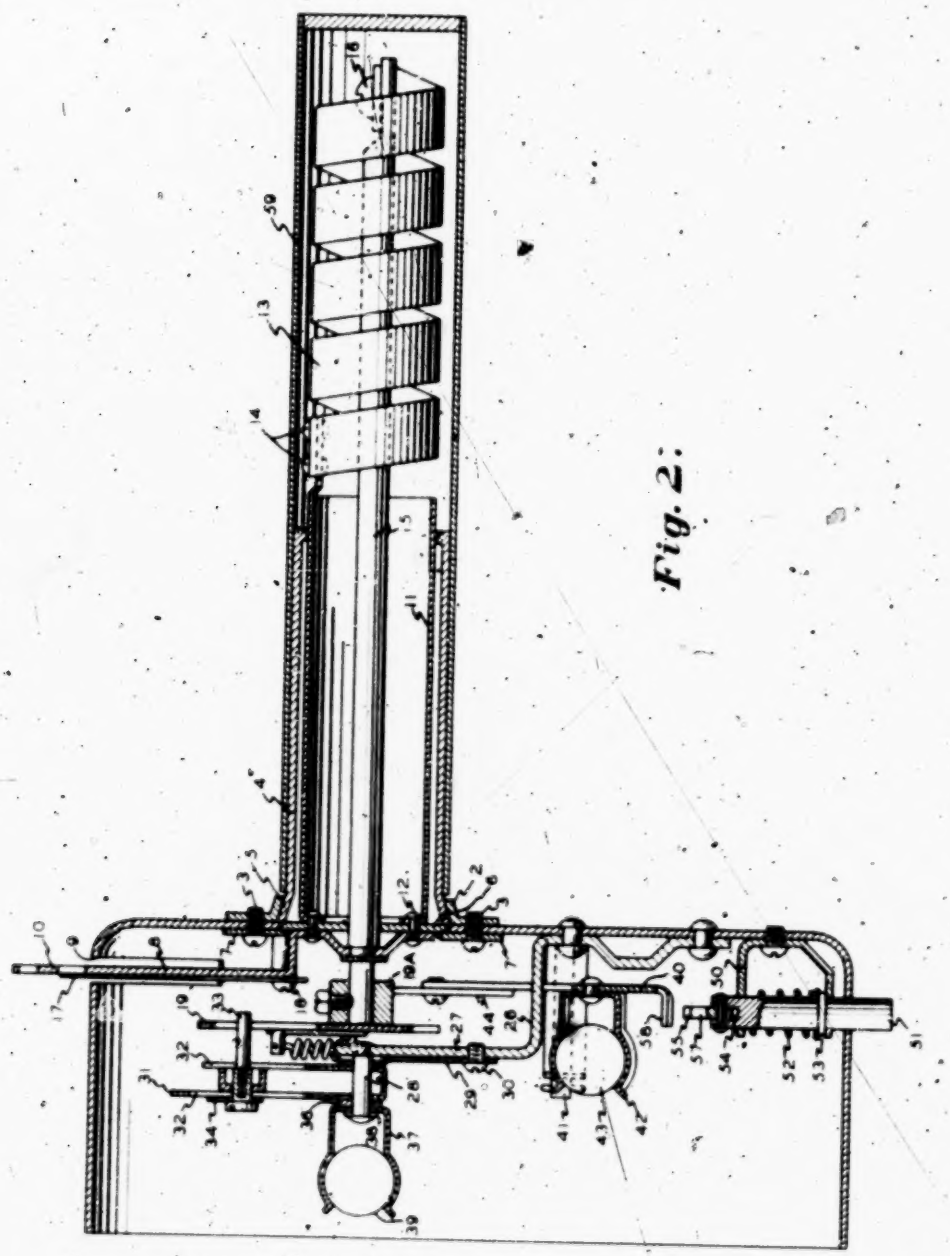

Fig. 2.

Inventor

Sylvanus C. Shipley

By George H. Fisher

Attorney

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# UNITED STATES PATENT OFFICE

2,117,514

## THERMOSTATIC SWITCHING MECHANISM

Sylvanus C. Shipley, Minneapolis, Minn., assignor to Minneapolis-Honeywell Regulator Company, Minneapolis, Minn., a corporation of Delaware

Original application April 20, 1932, Serial No. 606,440. Patent No. 2,063,898, December 15, 1936. Divided and this application August 1, 1934, Serial No. 737,917

18 Claims. (Cl. 200—139)

The present invention relates to improvements in control devices, such as a thermostatic switching mechanism.

One of the objects of the present invention is the provision of a switching mechanism which is moved to a new circuit controlling position upon the occurrence of an abnormal or undesired condition, the arrangement being such that the switch can then be manually returned to and latched in its original position while the abnormal or undesired condition persists, the switch being automatically returned to normal control whenever the condition returns to a normal or desired state.

Another object of the invention is the provision of a thermostatic switch that is moved to a new circuit controlling condition or position when the temperature to which the thermostatic actuator thereof responds becomes abnormal, providing manual means by which the switch can be returned to and latched in its original position, while the temperature remains abnormal, the arrangement being such that the switch is unlatched and returned to the control of the thermal actuator whenever the temperature thereafter returns to normal.

Another object of the invention is the provision of a mercury switch that is operated by a suitable actuator through a lost-motion connection and providing a friction mounting for the mercury switch that is sufficiently positive to maintain the mercury switch in any position to which it is moved whereby to prevent movement of the switch by the lead wires of the mercury switch.

A further object is the provision of an improved differential adjustment of the lost-motion type.

Other objects of the invention include the general improvement of thermostatic switching mechanisms, particularly those types in which a single thermal actuator operates a plurality of switches.

Other objects of the invention will be found in the description, the drawings and the appended claims.

The present application is a division of my copending application Ser. No. 606,440, filed April 20th, 1932, now Patent No. 2,063,898, December 15, 1936 and entitled "Control system for automatic stokers".

For a more complete understanding of the invention, reference may be had to the following detailed description and accompanying drawings, in which

Fig. 1 is a front view of my improved switching mechanism;

Fig. 2 is a longitudinal section of my improved switching mechanism taken about on line 2—2 of Fig. 1;

Fig. 3 is a fragmentary front view showing the lock-out switch held closed by the manually operable means; and

Fig. 4 shows one of the details of my improved switching mechanism.

The switching mechanism of the present invention is particularly adapted for controlling a stoker, and will be explained in this connection. Referring to the drawings, the switching mechanism is housed in a case 1, which is provided with an opening surrounded by flange 2, secured in place by screws 3. A tubular extension 4 is provided with an expanded end 5 and this tubular extension surrounds and partially covers the opening in case 1, the flange 2 operating to hold the tubular extension in place. A disc 6 substantially fills the opening in case 1 and abuts the periphery of the expanded end 5 of tubular extension 4 and this disc is held in place by means of washers 7 which are secured by screws 3. An operating handle 8 is secured to disc 6 by any suitable means, such as rivets, and extends through a slot 9 in case 1 and terminates in an indicator 10. A tubular member 11, which is concentric with and inside of extension 4, is secured at one end to disc 6, by means of inturned lugs, as shown at 12, and its other end is secured to one end of a helically coiled bimetallic element 13 as indicated at 14. A shaft 15 has one of its ends secured to the free end of bimetallic element 13, as shown at 16, and extends through the coil formed by this element, through disc 6, operating handle 8 and into the interior of case 1. A scale plate 17 is secured to the interior of case 1 by any suitable means, such as the screws shown at 18, and extends through slot 9 in case 1. Scale plate 17 is provided with high, low and intermediate graduations for co-operation with indicator 10 in order that the base temperature to which the device responds may be adjusted.

A cam plate 19, which is secured to a collar 19a, is mounted on the free end of shaft 15 by means of said collar. The cam plate 19 is substantially semi-circular in shape but has a cam surface provided in its periphery, as shown at 20. Cam plate 19 is also provided with a slot 21 of irregular shape. The slot 21 is provided with a straight radial portion 22, a lower arcuate portion 23, a curved side 24, and an elongated portion 25. The peculiar form of this slot has a

very definite purpose which will be brought out hereinafter. A bracket 26 is secured to case 1 below shaft 15 and is provided with an upwardly extended portion 27 provided with an opening which is in alignment with shaft 15. A pin 28 passes through this opening and is secured to extension 27. A leaf spring 29 has one end secured to extension 27, as shown at 30, and its other end is provided with an opening so as to allow the passage of pin 28 therethrough. A U-shaped actuated member 31 is pivoted on pin 28 and the upwardly extending legs thereof are provided with slots 32. A pin 33 extends through the slots 32 and into slot 21 and also clamps an indicator 34 to one of the legs of member 31, which indicator co-operates with graduations 35 carried by said leg. A star shaped friction washer 36 is next placed on pin 28 followed by a mercury switch holder 37 and then a washer 38 after which pin 28 is peened over. Leaf spring 29 exerts pressure against member 31 so that member 31 and switch holder 37 are coupled together by means of friction washer 36 and at all times rotate together about pin 28. The pressure exerted by leaf spring 29 is sufficient to maintain member 31 and mercury switch holder 37 in any position to which they may be moved. A mercury switch 39 is carried by holder 37. This mercury switch will hereinafter be termed the "fire maintaining switch".

The operation of this part of the device is as follows: With the indicator 10 set at any desired point, temperature changes at the bimetallic element 13 result in rotation of shaft 15 which in turn rotates cam plate 19. The edges formed by slot 21 engage pin 33 to move member 31 and in turn tilt the mercury switch 39. It will be noted that the graduations 35 are evenly spaced and in order for each graduation to represent the same number of degrees in temperature change, it has been necessary to provide the peculiar configuration of slot 21. With pin 33 moved up to such a position that indicator 34 is opposite graduation A, the extended end of pin 33 will be in the elongated portion designated 25 of slot 21. Under these conditions, as cam plate 19 is rotated back and forth in response to temperature changes at bimetallic element 13, fire maintaining switch 39 will be tilted back and forth without any lost motion. As indicator 34 is moved downwardly to positions B, C, D, etc., the end of pin 33 will move into progressively wider parts of the slot 21 so that there will be an increased amount of lost motion between cam plate 19 and pin 33 so as to provide an adjustable differential in the operation of fire maintaining switch 39. It has been formerly stated the pressure exerted by leaf spring 29 is sufficient to hold fire maintaining switch 39 and member 31 in any position to which they may be moved by the lost motion connection provided by pin 33 and slot 21. In former instruments, the mercury switch, after having moved past the center, has been allowed to continue rotating by gravity to the extent of the lost motion connection. This feature has been eliminated herein for a specific reason since it has been found that the lead wires to the mercury switch tend to hold the mercury switch in some one of its positions and even tend to move the switch back to such position when the force acting thereon has been removed. The pressure set up by leaf spring 29 is sufficient to overcome this tendency of the leads of the mercury switch and maintains it in any position to which it is moved by cam plate 19. The result is positive and accurate operation of the instrument. Adjustment of indicator 10 rotates tubular member 11 to adjust the fixed end of the bimetallic element 13 so as to change the base temperature setting of the instrument.

A bell-crank 40 is pivoted on a pin 41 carried by case 1 and has a substantially horizontal arm to which is secured a mercury switch holder 42, which in turn carries a mercury switch 43. This mercury switch will hereafter be termed the "lock-out switch". The other arm of the bell-crank is substantially vertically disposed and is provided with an adjustable extension 44 which carries a pin 45 at its end, the pin being adapted to cooperate or ride upon the periphery of cam plate 19. A cam 46 is pivoted to cam plate 19, as shown at 47, and is biased normally into engagement with a pin 48 by means of a coiled spring 49. The cam 46, when it is in engagement with pin 48, serves as an extension of the periphery of cam plate 19, so that in effect the periphery of the cam plate 19 extends in a perfect radius beyond the cut-in cam portion 20. A bracket 50 is secured to the lowermost portion of case 1 and journals a vertical movable rod 51 which is normally biased to move downwardly by means of a spring 52, one end of which abuts the bracket 50 and the other end of which abuts a washer secured to or an enlarged portion 53 formed in rod 51. The upper portion of rod 51 is slotted as at 54 to pivotally receive a catch 55. Catch 55 is provided with a downwardly extending finger 56 and also with a notch 57 located at its upper portion. The substantially horizontal arm of bell-crank 40 is provided with a bent-over extension 58 which overlies catch 55 and under certain conditions engages notch 57.

The part of the thermostatic switch just described above comprises the means for shutting down the stoker when the fire goes out. When the fire in the furnace goes out, the temperature of element 13 falls to such a degree that cam plate 19 is rotated in a clockwise direction until pin 45 rides over the periphery of cam 46 and drops against the portion 20 of cam plate 19, which allows bell-crank 40 to rotate clockwise about pin 41 moving lock-out switch 43 to open circuit position. If, for any reason, the temperature drops far enough to cause the opening of lock-out switch 43 and then due to a change of wind direction or for some other cause the fire picks up, increasing the temperature of element 13, cam plate 19 will be rotated in a counter-clockwise direction. Pin 45 will bear against the lower edge of cam 46 rotating the same in a clockwise direction against the action of the spring 49. On continued rise in temperature, pin 45 will ride up cam surface 20 until it reaches the radial periphery of cam plate 19 whereupon cam 46 will be returned to its normal position abutting pin 48. Cut-out switch 43 is moved to closed position by this action.

It should be noted that there is a temperature differential between opening of lock-out switch 43 and closing thereof under these conditions. In order for lock-out switch 43 to open, the temperature at thermostatic element 13 must drop to such a point that pin 45 rides off cam 46 which is then in engagement with pin 48 to extend the periphery of plate 19. For lock-out switch 43 to close automatically, however, the temperature must rise sufficiently for pin 45 to rotate cam 46 about its pivot and ride up on cam surface 20 until it engages the radial periphery of cam plate 19.

The stoker cannot be operated when lock-out switch 43 has moved to open circuit position as explained in the above-referred to parent application. If the fire goes completely out, it may of course be rekindled manually and built up until the temperature to which element 13 responds has become sufficiently high to move lock-out switch 43 to closed circuit position after which automatic operation will be resumed as above explained. Ordinarily, however, it will be desired to only start the fire manually and then let the stoker build up the fire. In order to accomplish this result, it is necessary that lock-out switch 43 may be manually moved to closed circuit position and then maintained in that position until the temperature of element 13 becomes sufficiently high to hold lock-out switch in closed circuit position by means of cam plate 19 and cam 46. If this operation is desired, the rod 51 is moved upwardly until finger 56 of catch 55 rests on bracket 50 and the left hand edge of slot 57 engages the left side of extension 58 and moves bell-crank 40 in counter-clockwise direction until lock-out switch 43 is in closed circuit position (see Fig. 3). This movement of bell-crank 40 positions pin 45 so that it will readily ride upon cam 46 when the temperature of element 13 has been restored. Rod 51 is maintained in its raised position by finger 56 resting on bracket 50 and finger 56 is held in this position by the engagement of notch 57 with the left side of extension 58. When the temperature of element 13 rises sufficiently, cam 49 will move counter-clockwise until it picks up pin 45 and moves it slightly to the left. This causes extension 58 to be moved up out of engagement with notch 57 whereupon spring 52 will move rod 51 down to the position shown in Figure 1.

It will be noted that this combined instrument has several adjustments. First the indicator 10 may be moved to adjust what might be called the base temperature at which the fire maintaining switch 39 will be moved to closed position by engagement of pin 33 with straight portion 22 of slot 21. Adjustment of pin 33 vertically changes the differential between opening and closing movements of switch 39, and lastly, adjustable extension 44 changes the temperature at which lockout switch 43 will be operated in relation to the base temperature setting.

In order to protect bimetallic element 13 from the corrosive effects of the products of combustion, a protecting tube 59 may be provided if desired.

While the switching mechanism of the present invention has been described in connection with the controlling of a stoker, it will be apparent that it has many other uses and can be modified in many respects without departing from the invention. I therefore intend to be limited only by the scope of the appended claims.

I claim:

1. A switching mechanism of the class described, comprising, in combination, a condition responsive actuator, a pivoted mercury switch, an adjustable lost motion connection adapted to provide a variable coefficient of action therebetween, said connection comprising a pin associated with said switch and a plate having an irregularly shaped aperture therein into which said pin projects, a scale plate having evenly spaced graduations thereon adjacent said pin, a pointer rigidly affixed to and carried by said pin cooperating with said scale, said aperture being substantially triangular, one side thereof comprising an arc whereby movement of said pointer and hence said pin any equal distance with respect to said scale plate causes a change in the value of the condition to which said actuator responds in equal amounts corresponding to said equal distance of movement.

2. A switching device of the class described, comprising in combination, a condition responsive actuator, switch means, an adjustable lost motion connection adapted to provide a variable coefficient of actuation therebetween, said connection comprising a pin associated with said switching means and vertically movable with respect thereto and a plate having an irregularly shaped aperture therein into which said pin projects, said aperture being substantially in the shape of a triangle, a scale plate having evenly spaced graduations therein adjacent said pin, a pointer rigidly affixed to and carried by said pin cooperating with said scale, one side of said triangular shaped aperture being in the form of an arc whereby movement of said pointer and hence said pin any equal distance with respect to said scale plate causes a change in the value of the condition to which said actuator responds in equal amounts, said aperture also having an extending portion at the apex thereof of a width substantially equal to the diameter of the pin whereby upon predetermined movement of said pin to engage said aperture said lost motion connection becomes a relatively positive connection.

3. In combination, an actuator movable in conformity to changes in a condition, a switch operable to open and closed position thereby, a carrier for said switch, an extension on said carrier, manually operable latch means to latch said switch in closed position when said actuator would normally cause said switch to assume open position, said latch means comprising a manually movable rod and a catch pivoted thereto, said catch being adapted to engage said extension, and means controlled by said actuator to release said extension from said catch when said actuator returns to a position in which it would normally place the switch in closed position.

4. A switching mechanism of the class described, comprising in combination, an actuator, a plate rotated thereby, a first switch, an adjustable lost motion connection between said plate and said first switch to provide an adjustable differential between opening and closing movements of said switch, a second switch, mechanism cooperating with said second switch and the periphery of said plate for operating said second switch and manually operable mechanism associated with said second switch for auxiliary operation thereof under certain predetermined conditions.

5. In combination, an actuator movable in conformity to changes in a condition, a switch operable to open and closed position thereby, a carrier for said switch, an extension on said carrier, manually operable latch means to latch said switch in closed position when said actuator would normally cause said switch to assume open position, said latch means comprising a manually movable rod and a catch pivoted thereto, said catch being adapted to engage said extension, and means controlled by said actuator to release said extension from said catch when said actuator returns to a position in which it would normally place the switch in closed position, said means comprising a cam movable by said actuator adapted to abut said carrier to move said extension.

6. A switching mechanism of the class described, comprising, in combination, an actuator, a pivoted mercury switch, and an adjustable lost motion connection adapted to provide a variable coefficient of action therebetween, said connection comprising a pin associated with said switch and a plate having an irregularly shaped aperture therein into which said pin projects, said aperture being substantially triangular, and one side thereof comprising an arc.

7. A switching device of the class described, comprising, in combination, an actuator, a pivoted mercury switch and an adjustable lost motion connection adapted to provide a variable coefficient of actuation therebetween, said connection comprising a pin associated with said switch and vertically adjustable with respect thereto and a plate having an irregularly shaped aperture therein into which said pin projects, said aperture being substantially in the shape of an unequally sided triangle one side thereof being vertically disposed relative to the line of movement of said pin, the base and one leg of said triangle being curved.

8. A switching device of the class described, comprising, in combination, an actuator, switch means and an adjustable lost motion connection adapted to provide a variable coefficient of actuation therebetween, said connection comprising a pin associated with said switch, and vertically movable with respect thereto and a plate having an irregularly shaped aperture therein into which said pin projects, said aperture being substantially in the shape of a triangle, and having an extending portion at the apex thereof of a width substantially equal to the diameter of the pin whereby upon a predetermined adjustment said pin engages in said portion and said lost motion connection becomes a relatively positive connection.

9. A device of the character described, comprising in combination, a condition responsive actuator, a switch, a cam having a high and a low surface with a relatively gradual incline therebetween revolvable by said actuator, a cam segment pivotally mounted on said cam adjacent a junction of said high and low surfaces, said segment having a relatively abrupt incline and covering when in one position said gradual incline between said high and low surfaces of said cam, said segment being operable to move said switch, the arrangement being such that upon rotation of said cam by said actuator in one direction said cam follower rides from said high surface upon said cam segment and moves to said low surface with a relatively abrupt movement, but upon rotation of said cam by said actuator when said cam follower rides upon a low surface of said cam, said cam follower rotates said segment about said pivot and rides up said relatively gradual incline to said high surface.

10. A device of the character described, in combination, a condition responsive actuator, a switch, a cam having a high and a low surface with a relatively gradual incline therebetween revolvable by said actuator, a cam segment pivotally mounted on said cam adjacent a junction of said high and low surfaces, said segment having a relatively abrupt incline and covering when in one position, said gradual incline between said high and low surfaces of said cam and said segment being operable to move said switch, the arrangement being such that upon rotation of said cam by said actuator in one direction said cam follower rides from said high surface upon said cam segment and moves to said low surface with a relatively abrupt movement, but upon rotation of said cam by said actuator when said cam follower rides upon a low surface of said cam, said cam follower rotates said segment about said pivot and rides up said relatively gradual incline to said high surface, and resilient means normally biasing said cam segment to said gradual incline covering position.

11. A device of the character described, in combination, a condition responsive actuator, a switch, a cam having a high and a low surface with a relatively gradual incline therebetween revolvable by said actuator, a cam segment pivotally mounted on said cam adjacent a junction of said high and low surfaces, said segment having a relatively abrupt incline and covering when in one position, said gradual incline between said high and low surfaces of said cam and said segment being operable to move said switch, the arrangement being such that upon rotation of said cam by said actuator in one direction said cam follower rides from said high surface upon said cam segment and moves to said low surface with a relatively abrupt movement, but upon rotation of said cam by said actuator when said cam follower rides upon a low surface of said cam, said cam follower rotates said segment about said pivot and rides up said relatively gradual incline to said high surface, spring means normally biasing said cam segment to said gradual incline covering position, and latch means manually operable to hold said cam follower out of engagement with said cam and cam segment irrespective of the position thereof.

12. A switching device comprising, in combination, an actuator, a pivoted, mercury switch, lead wires therefor, an adjustable lost motion connection between said actuator and the mercury switch adapted to provide a variable coefficient of actuation between said switch and said actuator, and means for maintaining said switch in any position to which it is moved by said actuator through said lost motion connection, the action of said means being sufficiently positive to prevent movement of the switch by the lead wires.

13. A switching mechanism of the class described comprising, in combination, an actuator, a plate rotated thereby, a first switch, an adjustable lost motion connection between said plate and said first switch to provide an adjustable differential between opening and closing movements of said switch, a second switch, and mechanism cooperating with said second switch and the periphery of said plate for operating said second switch.

14. A switching mechanism of the class described comprising, in combination, an actuator, a plate rotated thereby, the periphery of said plate having a curved portion concentric with the axis of rotation of the plate and a re-entrant portion, a first switch, an adjustable lost motion connection between said first switch and the actuator, a second switch, mechanism cooperating with the second switch and engaging the periphery of the plate for maintaining said second switch in a first switch operating position when said mechanism engages the curved portion of the periphery and in a second switch operating position when engaging the re-entrant portion, and manually operable means for locking said second switch in the first switch operating position when said mechanism is opposite said re-entrant portion, said means being automatically

unlocked when the plate is moved by the actuator to bring the curved portion of its periphery into engagement with said mechanism.

15. A switching mechanism of the class described, comprising, in combination, a first switch, a second switch physically independent of said first switch, an actuator responsive to a physical condition, means associated with said actuator and switches for operating the latter by the former, basic adjusting means for adjusting in unison the values of the physical condition at which said switches will be actuated, and means associated with one of said switches and said actuator for additionally adjusting this switch whereby it will be operated at different values of the physical condition with respect to the other switch and the basic adjustment.

16. A switching mechanism of the class described, comprising, in combination, a first switch, a second switch, an actuator responsive to a physical condition, means associated with said actuator and switches for operating the latter by the former, basic adjusting means for adjusting in unison the values of the physical condition at which said switches will be actuated, means for adjusting the differential in the variation in the physical condition at which one of said switches will be operated from one circuit controlling position to its other circuit controlling position and vice versa, and means for additionally adjusting the value of the physical condition at which the other of said switches will be operated without disturbing the adjustment of said first named switch.

17. In a switching mechanism of the class described, in combination, a thermostatic element, means for adjustably securing one end of said thermostatic element whereby the position of the relatively movable end thereof for any given temperature may be varied, a first switch, means associated with said switch and thermostatic element for adjustably predetermining the temperature differential at which said switch will be moved to open and closed positions, a second switch, connecting means associated with said second switch and the relatively movable end of the thermostatic element whereby the former is operated by the latter, and means for adjusting said connecting means whereby the position of the relatively movable end of said thermostatic element at which the second switch will be operated may be varied.

18. A switching mechanism of the class described, comprising, in combination, a first switch, a second switch physically independent of said first switch, an actuator responsive to a physical condition, means associated with said actuator and switches for operating the latter by the former basic adjusting means for fixedly adjusting in unison the values of the physical condition at which said switches will be actuated, and means for independently adjusting the differential in the variation of the physical condition at which one of said switches will be operated from one circuit controlling position to its other circuit controlling position without affecting the operation of the other switch.

SYLVANUS C. SHIPLEY.

1276 Northern District of Illinois, } ss.
Eastern Division. }

I, Hoyt King, Clerk of the District Court of the United States for the Northern District of Illinois, do hereby certify the above and foregoing to be a true and complete transcript of the proceedings had of record made in accordance with Designation and Additional Designation, filed in this Court in the cause entitled Mid-Continent Investment Company, a corporation, and Minneapolis Honeywell Regulator Company, Plaintiffs *vs.* The Mercoid Corporation, Defendant, No. 2070, as the same appear from the original records and files thereof now remaining in my custody and control.

In Testimony Whereof, I have hereunto set my hand and affixed the seal of said Court at my office, in the City of Chicago, in said District, this 13th day of May, A. D. 1942.

Hoyt King,
*Clerk.*

(Seal)

UNITED STATES CIRCUIT COURT OF APPEALS

For the Seventh Circuit.

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I, Kenneth J. Carrick, Clerk of the United States Circuit Court of Appeals for the Seventh Circuit, do hereby certify that the foregoing printed pages contain a true copy of Volume two of the printed record, printed under my supervision and filed on the seventeenth day of July, 1942, which together with Volume one, certified herewith under separate certificate, constitutes the record in the following causes:

Mid-Continent Investment Company and Minneapolis-Honeywell Regulator Company,
*Plaintiffs-Appellants,*

No. 8008 *vs.*

The Mercoid Corporation,
*Defendant-Appellee.*

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Mid-Continent Investment Company and Minneapolis Honeywell Regulator Company,
*Plaintiffs-Appellees,*

No. 8009 *vs.*

The Mercoid Corporation,
*Defendant-Appellant.*

as the same remains upon the files and records of the United States Circuit Court of Appeals for the Seventh Circuit.

In Testimony Whereof I hereunto subscribe my name and affix the seal of said United States Circuit Court of Appeals for the Seventh Circuit, at the City of Chicago, this 22nd day of April, A. D. 1943.

Kenneth J. Carrick,
(Seal) *Clerk of the United States Circuit Court of Appeals for the Seventh Circuit.*

At a regular term of the United States Circuit Court of Appeals for the Seventh Circuit, held in the City of Chicago and begun on the sixth day of October, in the year of our Lord one thousand nine hundred and forty-two, and of our Independence the one hundred and sixty-seventh.

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Mid-Continent Investment Company, a corporation, and Minneapolis-Honeywell Regulator Company,
*Plaintiffs-Appellants,*
No. 8008 *vs.*
The Mercoid Corporation,
*Defendant-Appellee.*

Mid-Continent Investment Company, a corporation, and Minneapolis-Honeywell Regulator Company,
No. 8009 *vs.*
The Mercoid Corporation,
*Defendant-Appellant.*

Appeals from the District Court of the United States for the Northern District of Illinois, Eastern Division.

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And, to-wit: On the fourteenth day of May, 1942, there was filed in the office of the Clerk of this Court, in cause No. 8008, an appearance of counsel for Appellants, which said appearance is in the words and figures following, to-wit:

IN THE CIRCUIT COURT OF APPEALS

For the Seventh Circuit.

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Mid-Continent Investment Company, a corporation; and Minneapolis-Honeywell Regulator Company,
*Plaintiffs.*
*vs.*
The Mercoid Corporation,
*Defendant.*
} Appeal No. 8008.

## ENTRY OF APPEARANCE.

Please enter our appearance as counsel for the appellants, Mid-Continent Investment Company and Minneapolis-Honeywell Regulator Company, respectively, in the above identified cause.

**Richard Spencer,**
Richard L. Johnston,
*Attorneys for Mid-Continent Investment Company.*

May 13, 1942.

William P. Bair,
Will Freeman,
*Attorneys for Minneapolis-Honeywell Regulator Company.*

May 13, 1942.

Endorsed: Filed May 14, 1942. Kenneth J. Carrick, Clerk.

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And on the same day, to-wit: on the fourteenth day of May, 1942, there was filed in the office of the Clerk of this Court, in cause No. 8009, an appearance of counsel for Appellant, which said appearance is in the words and figures following, to-wit:

UNITED STATES CIRCUIT COURT OF APPEALS

For the Seventh Circuit.

Cause No. 8009.

Mid-Continent Investment Company and Minneapolis-Honeywell Regulator Company

*vs.*

The Mercoid Corporation.

The Clerk will enter our appearance as counsel for The Mercoid Corporation.

Langdon Moore,
Langdon Moore,
53 W. Jackson Blvd.
L. Kerans Moore,
L. Kerans Moore,
53 W. Jackson Blvd.

Endorsed: Filed May 14, 1942. Kenneth J. Carrick, Clerk.

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And on the same day, to-wit: On the fourteenth day of May, 1942, there was filed in the office of the Clerk of this Court, in cause No. 8008, a Certificate to Exhibits, which said Certificate is in the words and figures following, to-wit:

United States of America
Northern District of Illinois } ss. No. 8008.
Eastern Division

I, Hoyt King, Clerk of the District Court of the United States for the Northern District of Illinois, do hereby certify that I herewith transmit to the United States Circuit Court of Appeals for the Seventh Circuit, certain original exhibits in the case entitled Mid-Continent Investment Company, a corporation, and Minneapolis-Honeywell Regulator Company, Plaintiffs *vs.* The Mercoid Corporation, De-

fendant, No. 2070, said exhibits are marked as follows, to wit:

Plaintiff's Physical Exhibits:

(a) Copy of Transcript of record in Missouri Suit—Exhibit No. 27;

(b) Reproduction of wiring diagram and infringing installation in the Smith home—Exhibit No. 37;

(c) Enlarged reproduction of diagram No. 1 of Exhibit 12,—Exhibit 38;

(d) Sketch showing the way a V2-3A relay would be connected in wiring system shown in Exhibit No. 40—Exhibit No. 39;

(e) Enlarged replica of solid line portions of diagram No. 1 of Exhibit 12—Exhibit No. 40;

(f) Reproduction of diagram 9 on page 6 of plaintiff's Exhibit 12—Exhibit 41;

(g) Stokatherm TJV 3—Exhibit 42;

(h) Mercoid M-11 Type thermostat—Exhibit No. 43;

(i) Type JMV Stokatherm—Exhibit No. 44;

(j) Reproduction of diagram at lower left-hand corner of back page of Exhibit 19—Exhibit No. 45;

(k) Control M-61 of Mercoid Corporation—Exhibit No. 49;

(l) Sleeve for JMV Stokatherm—Exhibit No. 50.

Defendant's Physical Exhibits:

(a) Mercoid Control M-51—Exhibit E-1;

(b) Mercoid Pyratherm M-1—Exhibit H-2;

(c) Mercoid Control M-55—Exhibit K-2.

In Testimony Whereof, I have hereunto set my hand and affixed the seal of said Court at my office in the City of Chicago, this 13th day of May, A. D. 1942.

Hoyt King,
(Seal) *Clerk.*

Endorsed: Filed May 14, 1942. Kenneth J. Carrick, Clerk.

And afterwards, to-wit: On the twelfth day of October, 1942, there was filed in the office of the Clerk of this Court, in causes Nos. 8008-8009, an appearance of counsel for Mid-Continent Investment Company, which said appearance is in the words and figures following, to-wit:

IN THE UNITED STATES CIRCUIT COURT OF APPEALS

For the Seventh Circuit.

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|---|---|
| Mid-Continent Investment Company, a corporation, and Minneapolis-Honeywell Regulator Company, *Plaintiffs-Appellants*, vs. The Mercoid Corporation, *Defendant-Appellee*. | Cause No. 8008. |
| Mid-Continent Investment Company, a corporation, and Minneapolis-Honeywell Regulator Company, *Plaintiffs-Appellees*, vs. The Mercoid Corporation, *Defendant-Appellant*. | Cause No. 8009. |

ENTRY OF APPEARANCE.

Please enter my appearance as additional counsel for Mid-Continent Investment Company in the above-entitled Causes of Action.

Lloyd C. Root.

October 10, 1942.

Endorsed: Filed October 12, 1942. Kenneth J. Carrick, Clerk.

And afterwards, to-wit: On the twentieth day of October, 1942, the following further proceedings were had and entered of record, to-wit:

Tuesday, October 21, 1942.

Court met pursuant to adjournment.

Before

Hon. William M. Sparks, Circuit Judge.
Hon. J. Earl Major, Circuit Judge.
Hon. Sherman Minton, Circuit Judge.

| | |
|---|---|
| Mid Continent Investment Co., *et al.*, *Plaintiffs-Appellants*, *vs.* The Mercoid Corporation, *Defendant-Appellee*. | Appeals from the District Court of the United States for the Northern District of Illinois, Eastern Division. |
| No. 8008 | |
| Mid Continent Investment Co., *et al.*, *Plaintiffs-Appellees*, *vs.* The Mercoid Corporation, *Defendant-Appellant*. | |
| No. 8009 | |

Now this day come the parties by their counsel, and this cause comes on to be heard on the transcript of the record and the briefs of counsel, and on oral argument by Mr. Lloyd C. Root, counsel for Mid-Continent Investment Co., by Mr. W. P. Bair for Minneapolis-Honeywell Regulator Co., and by Mr. Langdon, counsel for The Mercoid Corporation, and the Court takes this matter under advisement.

And afterwards, to-wit: On the twenty-third day of December, 1942, there was filed in the office of the Clerk of this Court, the Opinion of the Court, which said Opinion is in the words and figures following, to-wit:

IN THE UNITED STATES CIRCUIT COURT OF APPEALS

For the Seventh Circuit.

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**October Term and Session, 1942.**

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No. 8008.
MID-CONTINENT INVESTMENT COMPANY, a Corporation, and MINNEAPOLIS-HONEYWELL REGULATOR COMPANY,
*Plaintiffs-Appellants,*
*vs.*
THE MERCOID CORPORATION,
*Defendant-Appellee,*

No. 8009.
MID-CONTINENT INVESTMENT COMPANY, a Corporation, and MINNEAPOLIS-HONEYWELL REGULATOR COMPANY,
*Plaintiffs-Appellees,*
*vs.*
THE MERCOID CORPORATION,
*Defendant-Appellant.*

Appeals from the District Court of the United States for the Northern District of Illinois, Eastern Division.

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**December 23, 1942.**

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Before SPARKS, MAJOR and MINTON, *Circuit Judges.*

SPARKS, *Circuit Judge.* The original plaintiff, Mid-Continent Investment Company (hereafter referred to as Mid-Continent) charged the Mercoid Corporation (hereafter referred to as Mercoid), with contributory infringement of United States Combination Patent No. 1,758,146 to Cross. The patent was issued May 13, 1930, on an application filed November 11, 1926. On June 2, 1932, it was assigned to Mid-Continent, subject, however, to an exclusive license,

dated December 23, 1931, to Minneapolis-Honeywell Regulator Company (hereafter referred to as Honeywell).

The invention relates to improvements in domestic heating systems, and refers more particularly to a hot air system of heating in which the combustion gases passing to the flue are reduced in temperature in their passage through a heat exchanging device below the kindling temperature of wood. Among the particular objects of the invention are to provide a system having a furnace into which is mechanically and automatically fed a comminuted coal, such as disintegrated coal; also a system which is automatically controlled by a dual system of control, one phase of which operates the fuel feed and a force draft mechanism by variations in the room temperature, and the other operates the fuel feed and force draft by predetermined minimum temperatures in the furnace or combustion pot.

There are five claims and Claim 1 is typical: "A heating system comprising a combustion pot, means for feeding fuel thereto, a combustion space above the combustion pot, means controlled by the temperature of the rooms to be heated for automatically regulating the fuel feeding means, and a separate thermostatic control actuated by predetermined minimum temperatures in said combustion space for preventing extinguishment of the fire when operating under low heat requirement conditions."

The accused controls are referred to by the parties as Mercoid's M-61; TJV and M-11; and JMV.

The complaint alleges that the issues of validity and infringement by heating systems employing Mercoid's equipment, are *res adjudicata* in this suit by reason of their having been adjudicated in a proceeding in a District Court of Missouri, wherein the defense was conducted by the attorney for and at the expense of Mercoid. That court found, concluded, and decreed that this patent was valid and infringed by heating systems employing equipment made by Mercoid, and that decree was affirmed by the Eighth Circuit in *Smith* v. *Mid-Continent*, 106 F. 2d 622.

Mercoid in its answer herein denied infringement or that the patent was duly and legally issued to Cross, or that its validity was *res adjudicata*. It also counterclaimed upon the allegations of the answer that none of the elements of the combination were the invention of Cross, but all had been sold by Mercoid and its predecessor since the latter

part of November, 1925; that the effect of the Honeywell license to make, use and sell the old elements of the patent was to create a monopoly beyond the boundaries of the patent, which disclosed a lack of good faith and unfair competition and which had resulted in irreparable damage to Mercoid. It asked for a declaratory decree defining the parties' rights under the premises recited, for triple damages, and for injunctive relief both preliminary and permanent. Thereupon the court, upon Mercoid's motion, made Honeywell an additional party plaintiff. Thereafter Honeywell involuntarily appeared specially and replied to Mercoid's counterclaim, admitting its license, setting it forth as an exhibit, but denied all allegations as to a monopoly, conspiracy, bad faith, intimidation, misuse, coercion or improper threats. It alleged full and faithful performance of the license on its part and averred its willingness to release its exclusive license in order to permit Mid-Continent to license Mercoid if the latter so desired. This pleading avoided a response to all paragraphs of the counterclaim directed solely to allegations relating to Mid-Continent.

Mid-Continent replied to Mercoid's counterclaim, and besides denying its actionable allegations, averred that those sections purporting to seek relief under the Declaratory Judgment Act should be dismissed because they set up alleged causes of action that had previously been placed in issue by the complaint and Mercoid's answer. Furthermore, the reply urged that the entire counterclaim should be dismissed because all issues raised therein were *res adjudicata* in favor of Mid-Continent because of the fact that they were, or could have been, decided in *Mid-Continent v. Smith*, *supra*.

The District Court found the facts specially and therefrom concluded that neither Mercoid nor its dealer installed the heating system referred to in the Smith case, *supra*, and that the decree in that case was not *res adjudicata* against Mercoid as to contributory infringement of the Cross patent, nor to the defense of laches, nor to the defense that Mid-Continent had attempted through its method of doing business to expand its patent to monopolize the sale of combustion stoker switches.

It further concluded that Mid-Continent through its predecessor had knowledge of Mercoid's low limit control prior to the issuance of the patent, and that Mid-Continent was thereby guilty of laches in not instituting this action prior

to September 10, 1940, citing *Wheatley* v. *Rex-Hide*, 25 Fed. Supp. 543; 102 F. 2d 940.

The District Court further concluded that Mercoid M-61 stoker control was a modification of a patented Mercoid (Figure 50) furnace control which was on the market in 1925; that Mercoid M-61 was not built for the express purpose of providing purchasers with means to perform the Cross patented heating system and did not contribute to the infringement of the Cross patent in suit, nor did two other Mercoid devices, referred to as TJV and JMV.

It further concluded that Mid-Continent's method of doing business fell within the condemnation of *Carbice Corporation* v. *American Corporation*, 283 U. S. 27, and *Leitch Mfg. Co.* v. *Barber Company*, 302 U. S. 485, as the practical equivalent of granting a written license with the condition that the patented system might be practiced only with combustion stoker switches purchased from its licensees; that the patent was being utilized to gain a monopoly beyond its legitimate scope, and its sole purpose as used by Mid-Continent was to suppress competition in the manufacture and sale of combustion stoker switches; that Mid-Continent's method of doing business led to the suppression of competition in unpatented appliances and was sufficient to deny the relief sought in its complaint; that Mid-Continent was not in a position to maintain this suit, under the ruling of *American Lecithin Co.* v. *Warfield*, 105 F. 2d 207; that Mid-Continent had conspired with Honeywell which had developed its combustion stoker switch independently of the Cross patent, and marketed it before the grant of that patent, and then conspired with Mid-Continent in restraint of trade in interstate commerce to establish a monopoly in interstate commerce in an unpatented appliance beyond the scope of the patent in suit, in violation of the Anti-Trust laws; and that that conspiracy constituted a restraint of trade, and an attempt to monopolize, under 15 U. S. C. sections 1 and 2, by reason of which Mercoid was entitled to injunctive relief under section 4 of that title. See 43 Fed. Supp. 697.

On these conclusions the court decreed that the bill of complaint be dismissed, and enjoined each plaintiff from bringing suit for contributory infringement of the patent against Mercoid's customers, and from directly or indirectly threatening its customers with suit for such infringe-

ment of the patent, or in any manner interfering with Mercoid's business by use of the patent in suit.

It further decreed that the Honeywell license including power thereunder to Honeywell to also sub-license others to make, use and sell and to sub-license the invention of the system patent on the payment of a royalty on each sale of an unpatented appliance, and by conveying with each sale of such unpatented appliance in interstate commerce by Honeywell, a license to practice the invention of the patent in suit constituted a conspiracy and combination in restraint of trade in violation of 15 U. S. C. §§ 1 and 2. The decree further ordered a perpetual injunction against both plaintiffs, their officers and agents, both individually and collectively, from doing the following things:

(1) From further engaging in or carrying out said conspiracy or any other conspiracy having a similar purpose or effect;

(2) From doing any act or thing having the same purpose or effect as the acts done in pursuance of such controversy, or promoting, or tending to promote the purpose or effect thereof involving the patent in suit;

(3) From enforcing or carrying out, directly or indirectly, any of the provisions of the Honeywell license or its sub-licenses, or any similar licenses of the same tenor or effect, which involve the patent in suit.

Such injunction was ordered not to become effective until 45 days after the date of the decree. The decree dismissed the defendant's counterclaim with respect to damages, and the costs were assessed against both plaintiffs. All parties have appealed from this decree.

The validity of this patent is conceded. In *Smith* v. *Mid-Continent Investment Company, supra*, M-61 was involved, and the defenses were that there was no infringement, and that if the claims relied upon read upon the accused device, the patent was invalid as being an aggregation and a mere paper patent. Those issues were there decided adversely to Smith. He did not rely upon invalidity because of anticipation or prior publication, although he might have done so, and Mercoid might have done so, because it conducted and paid for the defense. Whether that decree is *res adjudicata* as to the question of infringement by the use of Mercoid's M-61 is of little moment at present, for we approve that opinion both in its logic and conclusions

with respect to infringement. That opinion very clearly sets forth the patent and its elements, and fully describes their functions, as well as those of M-61. They will not be repeated here, except to say that the separate thermostatic control (as described in Claim 1) actuated by predetermined minimum temperatures in the combustion space is the same as the M-61 control.

In that case Mercoid contended that plaintiffs' commercial structure placed this control in the breeching of the furnace, which is the by-pipe connected at one end to the furnace and at the other end to a portion of the flue extending from the furnace to the chimney, and that while a similarly functioning thermostat is in the accused structure, the patent locates the thermostat inside the fire pot of the furnace. The court in that case fully discussed this contention and held that the change of position by Mercoid of that particular thermostatic control was not sufficient to avoid infringement. With the reasons and conclusions of that court in this respect we fully agree, and for the same reasons we hold that M-61 when used in the Cross combination patent is an infringement of that patent.

The District Court thought that if Mercoid owned or controlled a valid patent on the element M-61, which it claims it does, it would have the right to make that element and to sell it to any one for any purpose. We think that would extend Mercoid's rights beyond the limits of the statute. We have no doubt that Mercoid under such circumstances would be permitted to make as many of those controls as it might desire without being guilty of infringement or contributory infringement, and if such control could be used for purposes other than that of Cross' combination, Mercoid could sell the element and fully instruct the purchasers as to such other uses, because plaintiffs do not hold a patent on the control itself. However, plaintiffs own and control the combination patent before us, of which the control in question is an element, and Mercoid will not be permitted to infringe that combination either directly or by contribution. If plaintiffs, without license, make use of Mercoid's patented control in its combination they would be liable to respond to Mercoid in profits or damages for such use, and it would seem that the rights of all parties under their respective patents would be fully protected.

Whether the use of Mercoid's T-IV and M-11 controls in domestic heating systems amount to infringement of the

Cross patent depends upon whether they operate at predetermined minimum temperatures. These controls are best illustrated by a comparison with M-61. The M-61 is directly connected with the automatic stoker and it operates at a predetermined low temperature to start the stoker when the temperature of the stack, or other place in the furnace where such control may be located, reaches that predetermined low degree. In other words, it causes the stoker to start feeding the furnace at an estimated time when the fire is soon likely to go out.

TJV and M-11 are two separate devices. They cooperate to produce the same result as does M-61. M-11, in operating position is placed whereever M-61 may be placed for operation, and in general outside appearance they are quite alike. M-11 is so constructed that it functions whenever the temperature at its location begins to drop. It is not directly connected with the stoker but it is directly connected electrically with TJV, and is designed to be located at any convenient place without the furnace. This latter device is also directly connected electrically with the stoker. It is so constructed as to close the circuit to the stoker at a predetermined period of time, after M-11 has functioned, usually from ten to sixty minutes, as the operator may desire. It contains, among other things, a clock like structure which measures the predetermined time, and at the expiration of that time TJV operates to close the switch to the stoker. Hence, when the room thermostat stops the stoker, and the temperature at M-11 begins to drop, the latter begins to operate, which starts the clock in TJV, which in turn starts the stoker at the end of the predetermined time.

In other words, M-61 operates to close the circuit directly to the stoker motor, after a predetermined low temperature in the stack has been reached, and operates to open that circuit after the fuel has been replenished and the stack temperature reaches a predetermined high. It also has a dial which can be set to enable the switch to open or close at a certain specified temperature. The M-11 switch, which instead of operating directly to close immediately the circuit to the stoker motor, operates a timing device which delays operation of the stoker for a predetermined period. After the fuel has been replenished and the stack temperature begins to rise, the M-11 operates to open the circuit to the timing device and immediately

stops further operation of the stoker. It has no dial for opening or closing the switch at certain specified temperatures. However, plaintiffs assert that the combination of M-11 and TJV still operates at a temperature which can be predetermined. Mercoid denies this assertion.

The undisputed evidence discloses that under ordinary conditions the average furnace, after being heated to a known high temperature, will cool at a known rate of speed and that such cooling under ordinary conditions of the furnace, when plotted on graph paper, using time against temperature, is generally known as the "cooling curve." Such a "cooling curve" was in evidence in the Smith case, *supra*, and can be made easily for any furnace. In a curve of that type, where the temperature is plotted against time, after the temperature of the furnace rises to a known high, it can be determined what the temperature in that furnace will be at the end of a given period of time. Hence, plaintiffs contend that since the TJV can be set to function at different intervals of time, then it can be determined, knowing from what high temperature the furnace is cooling, at what temperature the stoker will operate after any given period of time. True, the predetermined temperature involved in the "cooling curve" process is an approximation, and may be affected by different conditions in different furnaces, yet the undisputed evidence discloses that that approximation is very close to the predetermined temperature relied upon in M-61, and in the Cross patent, and all produce practically the same result.

The experts were substantially agreed on this but they differed as to the interpretation of the words in the claim "predetermined minimum temperatures." Mercoid's expert interpreted these words narrowly and thought that the word "predetermined" meant a rigidly fixed and specific degree of temperature at which the relay must operate at all times. Plaintiffs' expert based his opinion on a more liberal interpretation of that word. He said: "• • • it is my understanding that the patent is to be interpreted as broadly as possible in view of limiting prior art. Judge Reeves' decision (in the Smith case) was to the effect that the patent is entitled to extremely broad interpretation. Therefore, in the absence of limiting prior art, and there is no prior art in this particular situation that requires the patent to be limited to any particular operating temperature, it is my opinion the language over which Mr. Schultz

and I are in disagreement is entitled to a broad interpretation, and so interpreted covers not only the infringing arrangement shown in Exhibit 37 (Mercoid's wiring diagram, in its former infringing installation not here in issue) but also the TJV and JMV devices."

A reading of the Smith case convinces us that the interpretation of plaintiffs' expert is correct, and we think that the use of M-11 and TJV in the Cross combination is an infringement of that patent. In other words, we think that TJV and M-11, in conjunction, are actuated by predetermined minimum temperatures, in the combustion space, although expressed in terms of the known time in which those low temperatures will approximately be reached in the natural course of events.

The accused device JMV is merely a combination of TJV and M-11 in one device, and in its installation it is placed in the same position as M-11 or M-61. It works in the same manner and produces the same result as do the accused devices TJV and M-11. For the same reason, when used in Cross' combination, we think it clearly infringes the patent.

It is not here contended that Mercoid infringes the patent directly, for it does not sell or install furnaces. However, it does manufacture and sell the accused devices, or it has done so, and for the purpose of promoting those sales it has advertised extensively the use of such devices in the Cross combination to accomplish the same purpose in the same manner, or its equivalent, as does Cross with his control. Included in those advertisements are detailed specifications and drawings to aid the purchaser in making the installation. While the Cross patent, as such, is not referred to in those advertisements, yet it is asserted by plaintiffs, without contradiction, that there is no use for the accused devices other than in the patented Cross combination. We are unable to conceive of any other such use.

Under these circumstances we think it cannot be denied that a purchaser of any of Mercoid's accused devices, who used it in his furnace for the purpose intended by Mercoid, other than for repair and replacement made necessary by deterioration so as to preserve its fitness, would be guilty of infringement. *Leeds and Catlin Company* v. *Victor Talking Machine Company*, 213 U. S. 325. Likewise, under

the same circumstances, and under the ruling of the same case, we think Mercoid must be held guilty of contributory infringement. See also this court's ruling, *Fehr* v. *Activated Sludge, Inc.*, 84 F. 2d 948; *Lincoln Engineering Company* v. *Stewart-Warner Corporation*, 91 F. 2d 757. The latter case was reversed on the question of validity only, 303 U. S. 545.

There was much evidence offered by Mercoid and admitted, over plaintiffs' objections, disclosing prior use by Mercoid of its other controls, and patented controls of others, some of these uses being for more than a year prior to the date of the Cross application, and some later. None of the cited patents bore date of application or issuance as early as those of Cross, except the patent of McCabe, No. 1,734,016, which was earlier than Cross as to both. However, we assume that none of these prior uses nor the prior invention of McCabe discloses the invention of Cross, because of the presumption of validity of the Cross patent arising from its issuance, supported by the concession of the parties hereto that validity is not here in issue. Furthermore, the Cross patent is in combination, while McCabe, and the other uses admitted in evidence, refer only to one element of that combination, and Mercoid will not be permitted to infringe that combination by any contributive use of any of his controls in that combination, whether they be patented or not.

The only reason suggested by Mercoid for offering such evidence was to show that long before Mercoid existed it was customary in hot air heating systems to employ a room thermostat to control the operation of a motor to operate dampers, and with safety devices to close the dampers in case the temperature in the furnace became excessive. Neither McCabe nor any of the prior uses thus relied upon, except the accused devices of Mercoid, disclosed a thermostatic control actuated by predetermined minimum temperatures in the combustion space for preventing extinguishment of the fire when operating under low heat requirement conditions. Of course, McCabe's disclosures and the prior uses might be suggestive of the Cross disclosure to such an extent that one might consider the Cross disclosures as nothing more than mechanical skill, but again, that would involve validity with which we are not here concerned, unless the protection of public

interest demands it. We are convinced that such protection is not warranted here.

We realize that this court is bound by the findings of fact of the District Court, if they are supported by substantial evidence, but we are not bound by such findings unless they are so supported, nor are we bound by fact conclusions drawn therefrom. In this respect we refer more particularly to Findings 6, 11, and 12, and findings of fact contained in conclusion 4, with which we disagree. Finding 6 states that the accused controls do not operate at a predetermined low temperature. This we have heretofore discussed. Finding 11 states that there was no evidence that the Cross Coal-O-Matic Company (Mid-Continent's assignor) ever practiced the Cross invention prior to the assignment in 1930. Mr. Cross, Jr., gave affirmative testimony to the contrary, and it was not denied. Finding 12 refers to the royalty clause in the license agreements, and states that royalty payments were to be based upon what were known to the parties as combustion stoker switches, which the finding defines as "a combustion stoker control unit including an automatic electric switch responsive directly to temperatures of combustion gases or boiler water produced by an automatic coal fed stoker."

The license, however, defined this unit as a "combustion stoker control unit including an automatic electric switch responsive," as stated in the finding, but it further added as a part of such definition, *when such stoker and switch is "adapted, in combination with other devices and apparatus, for the control of automatically operated coal fuel stokers, to prevent the extinguishment of its fire when operating under low heat requirement conditions."* The District Court's ruling was to the effect that royalty payments under plaintiffs' license were to be based on any switch which was responsive directly to temperatures of combustion gases or boiler water produced by an automatic coal fed stoker, regardless of how the switch was to be used, when in fact the license states that royalty payments are to be based on such unit only when it is to be used with other devices and apparatus as a fire maintenance control. Conclusion of law 4 states that M-61 was not built for the express purpose of providing purchasers with means to perform the Cross heating system. It is not denied that it is one element thereof. The record discloses no other use, and

Mercoid suggests none. We think this finding has no factual support.

Plaintiffs further contend that the District Court erred in ruling that they are barred from maintaining this action because of laches in bringing it. Under the rulings of *Stearns-Roger Mfg. Co.* v. *Brown*, 114 Fed. 939; *Searchlight Horn Co.* v. *Victor Talking Machine Co.*, 261 Fed. 395; and *Smith Hardware Co.* v. *Pomeroy Co.*, 299 Fed. 544, we think this contention must be sustained. The District Court based its ruling in this respect upon *Wheatley* v. *Rex-Hide, Inc.*, 25 F. Supp. 543, affirmed, 102 F. 2d 940, and analogous cases. A reading of those cases, however, discloses facts which readily distinguish them from the facts before us, and from those set forth in the cases upon which we rely.

Appellants further contend that the District Court erred in holding that Mid-Continent's method of doing business with respect to the patent is the practical equivalent of granting a written license with the condition that the patented system may be practiced only with combustion stoker switches purchased from Mid-Continent's licensee, and in further holding that such conduct amounted to an unlawful combination in restraint of trade on the part of appellants, and an attempt on their part to suppress competition and to establish a monopoly in interstate commerce in an unpatented appliance beyond the scope of the Cross patent, in violation of 15 U. S. C. sections 1, 2 and 4.

We think the District Court's holdings in this respect are erroneous. Congress, by authority of our Constitution, has pledged the public faith to each patent owner to exclude others from practicing his invention for a limited time, and the anti-trust laws do not forbid contracts between the owners of patents and their licensees which are legitimate and within the scope of the patent. *Bement* v. *National Harrow Co.*, 186 U. S. 70. A patent owner, in the legitimate exercise of his rights, may restrain contributory infringement of his patent by the sale of the "advance of the art," if such sale is made with the knowledge and intention that the subject matter thus sold is to be used for the purpose of contributing to infringement of the patent. *Leeds & Catlin* v. *Victor*, 213 U. S. 325; *Wallace* v. *Holmes*, 29 Fed. Cases, No. 17,100; 9 Blatchf. 65.

It seems to us that there is nothing objectionable in Mid-Continent's method of doing business with respect to

this patent. It was a valid patent, as is conceded here, and the owner had a right to manufacture and sell the patented combination and to license others to do so. At first it attempted to manufacture and sell it, but after a short time it abandoned that course and granted and offered licenses to companies that would take them, including Mercoid, who refused. Moreover, Mid-Continent sent letters to non-licensed manufacturers who were contributing to the infringement of the patent. Finally, Mid-Continent granted an exclusive license to Honeywell, and by that act it lost all control over the further licensing of the patent but retained the right to bring suit against infringers, and upon that right this suit is instituted. There is nothing wrong in any of these actions providing the license did not exceed the limits of the patent, and herein lies the point in controversy.

Mercoid does not deny that Mid-Continent had the right to constitute Honeywell its exclusive licensee, but its contention is based on the method by which the royalties due from Honeywell to Mid-Continent are calculated, as set forth in section 2 of the license. The only complaint which Mercoid urges here is that the royalty payments are based on the stoker switch without regard to how or where this switch is to be used. We think, however, that this is a misinterpretation of the plain language of the license. The switch referred to is specifically defined in the claims as an automatic electric switch, which is responsive to stack temperatures or boiler water, and *which is used in combination with other devices and apparatus to prevent extinguishment of the fire when operating under low heat requirement conditions.* From this italicized language, which Mercoid does not emphasize in its argument, it is clear to us that Honeywell does not intend to pay, and Mid-Continent does not intend to receive royalties on any switch which is not used for fire maintenance purposes under the Cross patent.

It was upon such interpretation that Mid-Continent and Honeywell adopted the method of basing the royalties upon the control when thus used. This record discloses that Mid-Continent has never received royalty on anything other than complete installations coming within the scope of the Cross claims. If these accused controls can be used for any purpose other than in the Cross combination, Mercoid or anyone else is at liberty to sell and use them for that

purpose. If such control cannot be used for any other purpose, that fact would not give Mercoid any right to infringe the Cross combination either directly or by contribution. We see nothing here that would violate the anti-trust laws or that would constitute unfair competition. Certainly it cannot be said that notices given or circulars distributed to the trade, setting forth the licensee's rights under a patent, and warning against infringement, would constitute unfair competition. *Alliance Securities Co.* v. *DeVilbiss Mfg. Co.*, 41 F. 2d 668; *Cheney Co.* v. *Cunningham, et al.*, 37 Fed. Supp. 224. The only issue between Mercoid and Honeywell is whether the latter by itself, or in combination with others, attempted to use the Cross patent and monopolize an article beyond the bounds of the patent, and thereby violated the anti-trust laws. From what we have said we are convinced that Honeywell, under this evidence, is not guilty of that charge.

In support of Mercoid's contention to the contrary, it relies upon *Carbice Corporation* v. *American Patents Corp.*, 283 U. S. 27; *Leitch Mfg. Co.* v. *Barber Company*, 302 U. S. 458; *Morton Salt Company* v. *Suppiger Co.*, 314 U. S. 488; *American Lecithin Co.* v. *Warfield Co.*, 105 F. 2d 207, and other kindred cases. The facts in those cases are readily distinguishable from those here. They are consistent with the ruling in the case of *Leeds & Catlin* v. *Victor*, *supra*, and are so held by the Supreme Court in the Carbice and Leitch cases, *supra*.

Mid-Continent further contends that the case of *Mid-Continent* v. *Smith*, *supra*, is *res adjudicata* as to all questions which were there decided or which might have been put in issue and decided in that case. Honeywell does not and cannot present that issue here because it was not a party to that action, nor was it in any way connected with that case. As between Mid-Continent and Mercoid, we think the contention must be sustained, except as to the question of laches. See *Doherty Research Co.* v. *Universal Oil Products Co.*, 107 F. 2d 548; *Warford Corp.* v. *Bryan Screw Co.*, 44 F. 2d 713; *Galion Iron Works* v. *Adams Mfg. Co.*, 128 F. 2d 411; *General Motors Corp.* v. *Swan-Carburetor Co.*, 88 F. 2d 876. On the contrary, Mercoid relied upon *Minneapolis-Honeywell Co.* v. *Thermoco, Inc.*, 116 F. 2d 845, and analogous cases. It is clear from the reading of those cases that they are not here in point.

From what we have said it is clear that the District Court was not in error in disallowing damages under the cross complaint. In that respect the District Court's ruling is affirmed, and in all other respects it is reversed and this case is ordered remanded to the District Court for further proceedings not inconsistent with this opinion.

Endorsed: Filed December 23, 1942. Kenneth J. Carrick, Clerk.

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And on the same day, to-wit: On the twenty-third day of December, 1942; the following further proceedings were had and entered of record, to-wit:

Wednesday, December 23, 1942.

Court met pursuant to adjournment.

Before:

Hon. William M. Sparks, Circuit Judge.
Hon. J. Earl Major, Circuit Judge.
Hon. Sherman Minton, Circuit Judge.

Mid-Continent Investment Co., *et al.*, *Plaintiffs-Appellants*,
No. 8008 *vs.*
The Mercoid Corporation, *Defendant-Appellee*.

Appeal from the District Court of the United States for the Northern District of Illinois, Eastern Division.

This cause came on to be heard on the transcript of the record from the District Court of the United States for the Northern District of Illinois, Eastern Division, and was argued by counsel.

On Consideration Whereof: It is ordered, adjudged and decreed by this Court that the Decree of the said District Court in this cause appealed from be, and the same is hereby, affirmed, as to the disallowance of damages under the cross-complaint, and that in all other respects the decree is reversed, with costs, and that this cause be, and the same is hereby, remanded to the said District Court

for further proceedings not inconsistent with the opinion of this Court filed this day.

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Mid-Continent Investment Co., *et al.*, *Plaintiffs-Appellees.*
No. 8009 *vs.*
The Mercoid Corporation, *Defendant-Appellant.*

Appeal from the District Court of the United States for the Northern District of Illinois, Eastern Division.

This cause coming on to be heard on the transcript of the record from the District Court of the United States for the Northern District of Illinois, Eastern Division, and was argued by counsel.

On Consideration Whereof: It is ordered, adjudged and decreed by this Court that the Decree of the said District Court in this cause appealed from be, and the same is hereby, affirmed, as to the disallowance of damages under the cross-complaint, and that in all other respects the Decree is reversed, with costs, and that this cause be, and the same is hereby, remanded to the said District Court for further proceedings not inconsistent with the Opinion of this Court filed this day.

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And afterwards, to-wit: On the twenty-ninth day of December, 1942, there was filed in the office of the Clerk of this Court, in causes Nos. 8008-8009, a Stipulation to extend time to file Petition for Rehearing, which said Stipulation is in the words and figures following, to-wit:

IN THE UNITED STATES CIRCUIT COURT OF APPEALS

For the Seventh Circuit.

| | |
|---|---|
| Mid-Continent Investment Company, a Corporation, and Minneapolis-Honeywell Regulator Company, *Plaintiffs-Appellants,* *vs.* The Mercoid Corporation, *Defendant-Appellee.* | Appeal No. 8008. |
| Mid-Continent Investment Company, a Corporation, and Minneapolis-Honeywell Regulator Company, *Plaintiffs-Appellees,* *vs.* The Mercoid Corporation, *Defendant-Appellant.* | Appeal No. 8009. |

STIPULATION.

It is hereby stipulated by and between the parties to the above entitled causes that the time within which The Mercoid Corporation may file a petition for rehearing be extended to and include January 17, 1943.

Richard L. Johnston,
*Attorneys for Mid-Continent Investment Company*
135 South La Salle Street
December 28, 1942 Chicago, Illinois

Bair & Freeman
*Attorneys for Minneapolis-Honeywell Regulator Company*
135 South La Salle Street
December 28, 1942 Chicago, Illinois

Langdon Moore
*Attorney for The Mercoid Corporation*
53 West Jackson Boulevard
December 28, 1942 Chicago, Illinois

Endorsed: Filed December 29, 1942. Kenneth J. Carrick, Clerk.

And on the same day, to-wit: On the twenty-ninth day of December, 1942, the following further proceedings were had and entered of record, to-wit:

Tuesday, December 29, 1942.

Court met pursuant to adjournment.

Before:

Hon. William M. Sparks, Circuit Judge.

Mid-Continent Investment Co., *et al.*, *Plaintiffs-Appellants*, vs. The Mercoid Corporation, *Defendant-Appellee*.
No. 8008

Mid-Continent Investment Co., *et al.*, *Plaintiffs-Appellees*, vs. The Mercoid Corporation, *Defendant-Appellant*.
No. 8009.

Appeals from the District Court of the United States for the Northern District of Illinois, Eastern Division.

Pursuant to stipulation of counsel, it is ordered that the time for The Mercoid Corporation to file a petition for rehearing in this cause be, and the same is hereby, extended to and including January 17, 1943.

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And afterwards, to-wit: On the sixteenth day of December, 1943, there was filed in the office of the Clerk of this Court, a Petition for a Rehearing, which said Petition for a Rehearing is not copied here.

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And afterwards, to-wit: On the twenty-sixth day of January, 1943, there was filed in the office of the Clerk of this Court, an Answer to Petition for Rehearing, which said Answer is not copied here.

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And afterwards, to-wit: On the twenty-seventh day of March, 1943, the following further proceedings were had and entered of record, to-wit:

Saturday, March 27, 1943.

Court met pursuant to adjournment.

Before:

Hon. William M. Sparks, Circuit Judge.
Hon. J. Earl Major, Circuit Judge.
Hon. Sherman Minton, Circuit Judge.

| | |
|---|---|
| Mid-Continent Investment Co., *et al.*, *Plaintiffs-Appellants*, vs. The Mercoid Corporation, *Defendant-Appellee*. | Appeals from the District Court of the United States for the Northern District of Illinois, Eastern Division. |
| No. 8008 | |
| Mid-Continent Investment Co., *et al.*, *Plaintiffs-Appellees*, vs. The Mercoid Corporation, *Defendant-Appellant*. | |
| No. 8009 | |

It is ordered by the Court that the petition for a rehearing of this cause be, and it is hereby, denied.

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And afterwards, to-wit: On the thirty-first day of March, 1943, there was filed in the office of the Clerk of this Court, a Notice and Motion to Stay Mandate, which said Notice and Motion are in the words and figures following, to-wit:

IN THE UNITED STATES CIRCUIT COURT OF APPEALS

For the Seventh Circuit.

| | |
|---|---|
| Mid-Continent Investment Company, a corporation, and Minneapolis-Honeywell Regulator Company, *Plaintiffs-Appellants,* vs. The Mercoid Corporation, *Defendant-Appellee.* | Cause No. 8008. |
| Mid-Continent Investment Company, a corporation, and Minneapolis-Honeywell Regulator Company, *Plaintiffs-Appellees,* vs. The Mercoid Corporation, *Defendant-Appellant.* | Cause No. 8009. |

NOTICE.

To: Spencer, Marzall, Johnston & Cook
135 South La Salle Street
Chicago, Illinois
—and—
Bair & Freeman
135 South La Salle Street
Chicago, Illinois

Please Take Notice that I am this day filing with the Clerk of the Circuit Court of Appeals for the Seventh Circuit the attached Motion.

Langdon Moore
L. Kerans Moore
*Attorneys for The Mercoid Corporation*
53 West Jackson Boulevard
Chicago, Illinois

Copy of the above Notice with Motion attached thereto received this 30th day of March, 1943.

(s) Richard L. Johnston
*Attorneys for Mid-Continent Investment Company*

(s) Bair & Freeman
*Attorneys for Minneapolis-Honeywell Regulator Company.*

IN THE UNITED STATES CIRCUIT COURT OF APPEALS

For the Seventh Circuit.

| | |
|---|---|
| Mid-Continent Investment Company, a corporation, and Minneapolis-Honeywell Regulator Company, *Plaintiffs-Appellants*, *vs.* The Mercoid Corporation, *Defendant-Appellee.* | Cause No. 8008. |
| Mid-Continent Investment Company, a corporation, and Minneapolis-Honeywell Regulator Company, *Plaintiffs-Appellees*, *vs.* The Mercoid Corporation, *Defendant-Appellant.* | Cause No. 8009. |

## MOTION.

Now comes The Mercoid Corporation, defendant-appellee in Cause No. 8008 and defendant-appellant in Cause No. 8009, and moves this Honorable Court to stay the mandate in the above entitled causes for 30 days in order for The Mercoid Corporation to apply to the Supreme Court of the United States for a writ of certiorari to review the decision

of this Court, petitio.. for rehearing denied March 27, 1943.

The Mercoid Corporation,
By Langdon Moore
L. Kerans Moore
*Its Attorneys.*

Endorsed: Filed March 31, 1943. Kenneth J. Carrick, Clerk.

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And afterwards, to-wit: On the first day of April, 1943, the following further proceedings were had and entered of record, to-wit:

Thursday, April 1, 1943.

Court met pursuant to adjournment
Before:

Hon. William M. Sparks, Circuit Judge.

Mid-Continent Investment Co., *et al.*, *Plaintiffs-Appellants*, vs. The Mercoid Corporation, *Defendant-Appellee*. No. 8008

Mid-Continent Investment Co., *et al.*, *Plaintiffs-Appellees*, vs. The Mercoid Corporation, *Defendant-Appellant*. No. 8009

Appeals from the District Court of the United States for the Northern District of Illinois, Eastern Division.

On motion of counsel for The Mercoid Corporation, it is ordered that the issuance of the Mandate of this Court in this cause be, and it is hereby, stayed pursuant to Rule 25 of the Rules of this Court.

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UNITED STATES CIRCUIT COURT OF APPEALS

For the Seventh Circuit.

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I, Kenneth J. Carrick, Clerk of the United States Circuit Court of Appeals for the Seventh Circuit, do hereby certify that the foregoing printed pages contain a true copy of the proceedings had and papers filed, excepting briefs of counsel, petition for rehearing and answer thereto, and stipulations extending time for filing briefs, in causes

Mid-Continent Investment Company, and Minneapolis-Honeywell Regulator Company,
*Plaintiffs-Appellants,*

No. 8008 *vs.*

The Mercoid Corporation,
*Defendant-Appellee.*

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Mid-Continent Investment Company, and Minneapolis-Honeywell Regulator Company,
*Plaintiffs-Appellees,*

No. 8009 *vs.*

The Mercoid Corporation,
*Defendant-Appellant,*

as the same remains upon the files and records of the United States Circuit Court of Appeals for the Seventh Circuit.

In Testimony Whereof I hereunto subscribe my name and affix the seal of said United States Circuit Court of Appeals for the Seventh Circuit, at the City of Chicago, this 22nd day of April, A. D. 1943.

Kenneth J. Carrick,
(Seal) *Clerk of the United States Circuit Court of Appeals for the Seventh Circuit.*

SUPREME COURT OF THE UNITED STATES, OCTOBER TERM, 1943

No. 54

ORDER ALLOWING CERTIORARI—Filed June 1, 1943

The petition herein for a writ of certiorari to the United States Circuit Court of Appeals for the Seventh Circuit is granted.

And it is further ordered that the duly certified copy of the transcript of the proceedings below which accompanied the petition shall be treated as though filed in response to such writ.

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SUPREME COURT OF THE UNITED STATES, OCTOBER TERM, 1943

No. 55

ORDER ALLOWING CERTIORARI—Filed June 1, 1943

The petition herein for a writ of certiorari to the United States Circuit Court of Appeals for the Seventh Circuit is granted.

And it is further ordered that the duly certified copy of the transcript of the proceedings below which accompanied the petition shall be treated as though filed in response to such writ.